Popular Science

FOUNDED MONTHEY 1872



GENE TUNNEY TELLS HOW HE BEAT DEMPSEY

See Page 28

25 CENTS

New! The



Now you can build models in colors!

You've never seen anything like it, fellows! Look at the beautiful models on this page with their lustrous coloring—all made with the new Multicolor Meccano. Part after part gleams with brilliant colors, that's why the models are so realistic. And all the fine engineering quality for which Meccano has always been famous, is still there.

We wanted the best colors we could find so we selected Duco, the same genuine Duco that is used on the finest automobile bodies—you'll probably find it on Dad's new car. This gives a hard tile-like finish that does not crack or peel like ordinary paints. And Duco-finished parts cannot rust.

Get the newest thing in construction toys. Building with Meccano is dead easy. No study required. Build your models in bright colors—flaming red for the Fire Engine, olive green for the Tank Car—only Multicolor Meccano gives you this, yet it costs no more.

You'll certainly give the gang a surprise when you display your up-to-the-minute Multicolor outfit. No more colorless, dull models for you — be a leader! This is the day of the new Multicolor Meccano,

There are sets from \$1.00 to \$45.00. Two dandy specials at \$5 and \$10 include motors, See them at your dealers.

Send for this Free Book

It's an interesting story estitled, "How Jack Discovered the Perfect Toy." It will tell you all about the new Multicolor Meccano. Sent free for your name and address and those of three of your chams. Put No. K-2 after your own name for reference.

MECCANO COMPANY, INC., Div. K-Z., Elizabeth, N. J.

In Canada: Meccano Ltd., 45 Colborne St., Toronto



Special No. 3x Outfit - S11.50

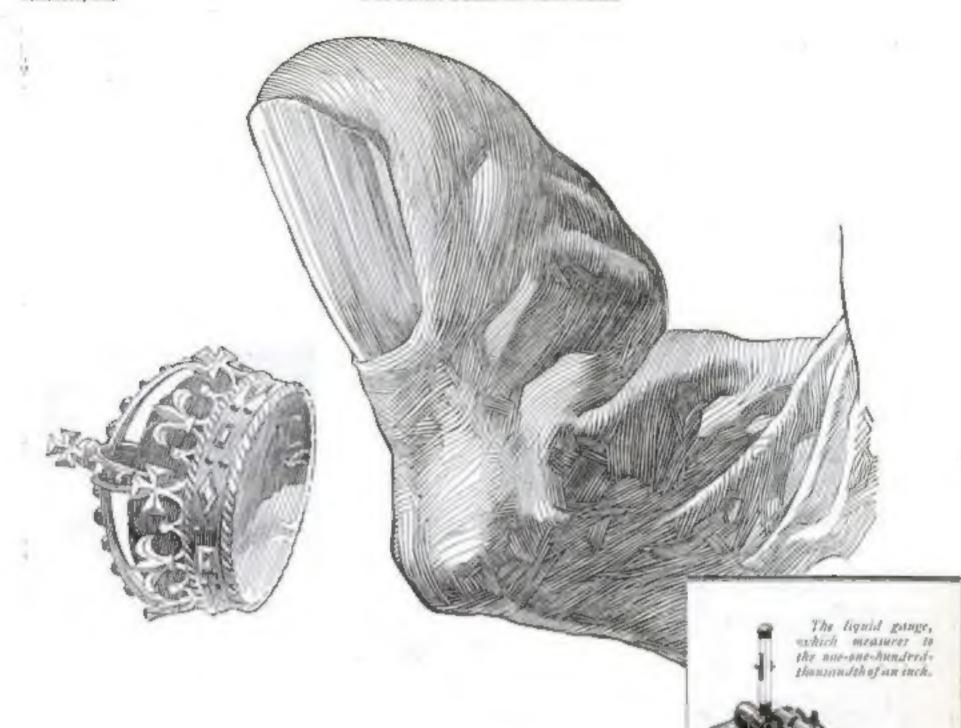
Reduced to \$10.00

A fine big outfit full of valuable parts for building hundred sorting models. Has a powerful, reversing electric motor and lag book showing how to make over 200 models. Sent prepaid upon receipt of price if not at your dealer's.



THE QUALITY TOY

- Cr C1 4



The rule of thumb is over...

KING THUMB rules no more. The rule of thumb, with all its costly guesswork, has no place in Western Electric telephone making.

Here exact measuring standards are the rule, precise in many cases to the ten-thousandth part of an inch. And this habit of being exact controls every factory activity—in the systematic planning of the great task of telephone production, in manufacturing to known standards of quality, in constantly improving methods of work—not in hap-hazard experiment but by scientific attack by a group of skilled industrial engineers.

At the same time, as makers of the nation's telephones, Western Electric is meeting its responsibility by holding down the cost of telephone apparatus to a figure well below the increased cost of general commodities.

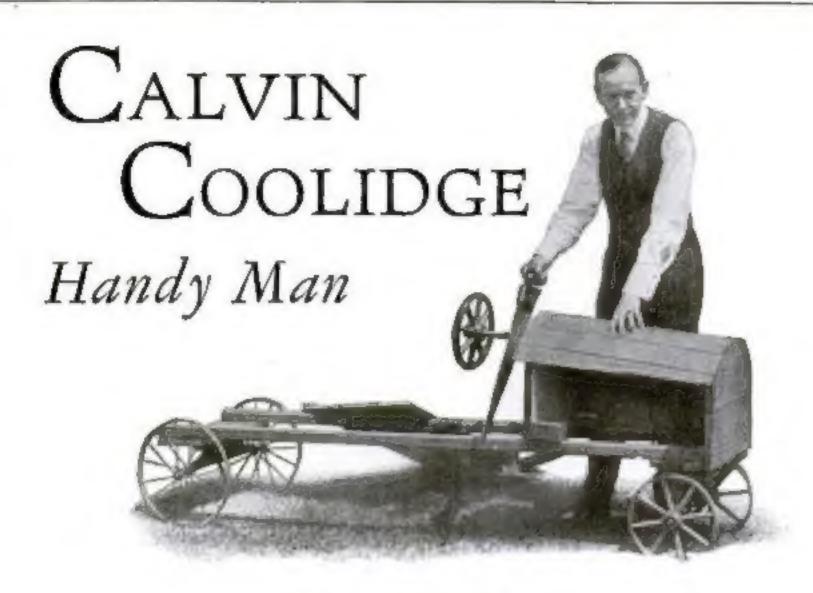


Inche like a bomb, but really a little "dark room" which permits the inspector to know exactly whether a tiny switchboard lamp comes up to the mark.



Western Electric

SINCE 1882 MANUFACTURERS FOR THE BELL SYSTEM



AN EDITORIAL

States, was seated in an old-fashioned green wicker rocking chair. His felt hat was pushed comfortably back on his head. On the floor sat Bruce Barton, an old friend. They talked of this and that, as friends will. Plymouth, the little Vermont village, where Coolidges have lived for generations, was mentioned. And, according to Mr. Barton, who wrote of the chat for The Associated Press, the President said:

"Plymouth gives me something I need in my work and cannot get anywhere else. If I find a strap broken, I like to get out the tools used by shoemakers, make a waxed end and repair it. I like to do a little blacksmithing around what is left of our old shop, try my hand again with the carpenter's tools, go out and repair the fence where it is breaking down, and mend the latch on the kitchen door."

POOD for thought there. The head of the biggest business institution in the world, the United States Government, finds inspiration and solace in the little tasks you and I do about our homes. He is one of a constantly growing group of American leaders who know the value of a tool chest and a home workshop in giving the human mind the rest it needs.

Calvin Coolidge, Handy Man! It is a title the President can wear with honor. Thousands of Americans, in every walk of life, wear it. Hundreds of them write to this magazine every week. My banker is building a radio set and my lawyer is shingling his house. Look about your town. You can find doctors mending leaky wash boilers, ministers making ship models and accountants building bobsleds. And each of them is doing his daily task a little better because of the stimulation he gets from his hobby.

THE President is right. Plymouth gives him something he needs in his work. There is something about handicraft that brings a man closer to the kind of people who make up the backbone of the nation. The thought of the President as a handy man allies him with you and me and that father who, just before Christmas, sneaked up to his home workshop in the attic, praying that his little daughter Mary wouldn't discover him.

"And why?" asked Gilbert P. Symons, the Cincinnati clergyman who told us about him. "Doll's house! Two stories with bathroom and cupola. Glazed windows. Green and white color varnish. Real shingles made from printed linoleum. A house that Mary won't forget if she lives to be ninety. A house that is holy because that father made it with his own hands. A man that is twice a father because he is a handy man!"

I can't help but feel that perhaps Mr. Coolidge is a better President because he is a handy man.—S.N.B.

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States, its posterrious, and Canada, it2 lift foreign countries, it. The rentioning of this magazine must not be reprinted without permission. In presenting in its relaterial columns numerous stories of new products of applied wience. Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. The use of Popular Science Monthly articles for speck-selling schemes is never subborised. O. S. Capen, Procident and Transarur. H. C. Wilson, Vice-President; A. L. Cole, Secretary.

The new Balkite"B" at \$2750 and the

Balkite Trickle Charger furnish all radio



The New Balkite Charger

MODEL J. Has two charging rates. A low trickle charge rate and a high rate for rapid charging and basey duty use. Can thus be used either as a trickle or as a high rate charger and combines their advantages. No iseless. Large water capacity, Visible electrolytelevel. Rates with 6-volt battery, 2-5 and .5 amperes with 4-volt battery, 8 and .2 amperes. Special model for 25-40 cycles. Price \$19.50. West of Rockies \$20. In Canada \$37.50.)



Balkite Combination

When connected to the "A" bettery this new Balkite Combination Radio Power Unit supplies automatic power to both "A" and "B" circuits. Controlled by the filament switch already on your set. Entirely automatic in operation. Can be put either near the set or in a remote location. Will serve any set now using either 4 or 6-volt "A" butteries and requiring not more than 30 toilliamperus at 135 volts of "B" current—practically sil sets of up to 8 subm. Price \$59.50 (In Canada \$63.)

All Balkite Radio Power Units operma from 110-120 only AC current with models for both 60 and 50 cycles. The new Balkite Charger is also made in a operial model for 15-40 cycles. The light socket is your most convenient source of radio power. Use it by adding the new Balkite "B" and the Balkite Trickle Charger to your radio set.

Balkite "B"—the unique "B" power supply—eliminates "B" batteries entirely and supplies "B" current from the light socket. The new Balkite "B"-W at \$27.50 serves any set of 5 tubes or less requiring 67 to 90 volts. Balkite "B"-X at \$42 serves sets of up to 135 volts and 8 tubes. Balkite "B"-Y at \$69 serves any standard set.

The Balkite Trickle Charger at \$10*

is probably the most popular of all chargers. Over 200,000 were purchased during one season and are now in service. Instead of operating intermittently at a high rate, it operates continuously at a low rate, thus automatically keeping the battery at full charge. In effect it converts your "A" battery into a

light socket "A" power supply. With 4-volt batteries it can be used as an intermittent charger, or as a trickle charger if a resistance is added.

Both Balkite "B" and the Balkite Trickle Charger are noiseless in operation. Both are permanent pieces of equipment, with nothing to renew or replace, Other than a slight consumption of household current, their first cost is the last. Both are built to conform with standards set by the Underwriters' Laboratories.

Over 650,000 radio sets are already Balkite equipped. Make yours a light

socket receiver too by adding these Balkite Units. Enjoy the pleasure of owning a radioset always ready to operate at its best.

*Balkite Trickle Charger \$10.50 west of Rockies. In Canada, Trickle Charger \$15; "B"-W \$39; "B"-X \$59.50; "B"-Y \$96. Fansteel Products Co., Inc., North Chicago, Illinois.

The Balkite

Radio Symphony Concerts with WALTER DAMROSCH and the New York Symphony

These concerns will be broadcast every other Saturday Evening, beginning October 23d. On intervening Saturdays Mr. Damroach will give a piano lecture recital alone. At 9 P. M. Eastern Standard Time, over a group of 12 sentions: WEAF, WEEL, WGR, WFL, WCAE, WSAI, WTAM, WWI, WGN, WCCO, KSD, WDAF.

Balkite Radio Power Units



The purpose of this new Department is to help Readers of POPULAR SCIENCE MONTHLY save money and invest it safely and profitably

How HERBERT CLARK Gained Financial Independence in 15 Years

By WALLACE AMES, Financial Editor

R. FOW LER had been President of the First National Bank from its beginning and under his direction it had grown to be a large institution. But the Bank's expansion had not changed Mr. Fowler much. His desk was still out in front where he could meet customers. He always made it a point to keep in close personal touch with them. For over thirty years Mr. Fowler had watched the progress of the Bank's depositors, or at least the progress of some of them,-the ones who were getting ahead. He had lived a full business life close to the financial affairs of his fellow-townsmen. He knew a lot about the money problems of the average man.

It was the last business day of the year. After banking hours Mr. Fowler and the Cashier were going over the Bank's statement together. On this particular occasion a whole parade of the Bank's depositors seemed to be passing before Mr. Fowler's mind and finally his conversation drifted into an unusually interesting

channel.

"DO YOU know, Fred," remarked Mr. Fowler, "I have come to the conclusion that it takes only about lifteen out of theseventy years of a man's life to settle his financial success. Whenever I look over the records of the men who carry their personal accounts here in the Bank I am impressed with the unusual importance of the comparatively short stretch of fifteen years in the average man's welfare. And often I wonder why more men. young men, middle-aged men, and even older men, do not figure out how much they can do in fifteen Carefully planned years and how much easier and pleasanter everything would be for them as a result.

To illustrate what I am driving at just take some of the men who have been calling on me today. Take the case of Herbert Clark who has just been made Vice-President of his company. Herbert came to this town right from college and started to work for \$18 a week. He is still under forty,

worth \$53,000. He has \$8,000 equity in his house, owns \$20,000 stock in his company and \$25,000 in good bonds. He has done all that in a little over fifteen years."

A New Service

POPULAR SCIENCE MONTHLY

THIS new Department is to help readers in the establishment of proper anancial programs at the beginning of their business careers; it assists those who have accumulated money in the proper investment of it so that it will be safe and so that it will grow.

The Editor of this Department is an authority on investment matters and he will not only every month give the readers interesting and useful information in his articles, but is also ready to aid in personal investment problems. Advice will be gladly given regarding the proper investment of funds and proper plans of saving.

Address all your inquiries to Wallace Ames, Financial Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York.

Any advertising appearing in this section will be carefully investigated by the Publisher of POPULAR SCIENCE MONTHLY. Readers can be sure that companies advertising are reliable and that they offer securities which represent sound financial investments. While investments obviously cannot be guaranteed by the Publisher, every effort will be made to insure that only advertisements of absolutely reliable companies are accepted.

"Everyone knew that Herbert Clark was going to make good," the Cashier remarked, "and I have seen him coming right along, but I did not realize he was that well off. How did he do it?"

Well, the beginning of Clark's financial success is recorded right here in our savings department. He opened an account when he drew his first week's pay—began by saving \$5 a

week out of his \$18. And if you look up the records you will find that every year Herbert increased his weekly savings deposit. He increased it as regularly as his salary was increased. These savings were later invested in bonds. It took two years of savings and interest to get the first \$1,000 of bonds. From that time on he added at least one \$1,000 bond a year. By the time he was married eight years ago Herbert had accumulated \$10,000 in bonds. He did not save all this out of his salary; interest helped a lot.

"THE YEAR that Herbert was made. Assistant Sales Manager he put his savings for that year into a first payment on a home. And since then he has used his bond interest to pay on the house. A year or two later his Company gave Herbert a chance to acquire some stock on easy terms and at a very good figure. So for two years he invested in the Company's stock. The stock he paid \$8,000 for is worth fully \$20,000 now. Of course this was an unusually profitable investment, but the point is that Herbert had the money to take advantage of it when the opportunity came-

"Herbert Clark told me today he had figured up that interest and dividends on his savings had amounted to over \$22,000 in the last lifteen years. His income from stock and bonds is

now \$3,500 a year."

"Clark will be a rich man before long." observed the Cashier. "The money he laid by during the past fifteen years will fix him so he can take advantage of many opportunities which always come to the man with money. And he has always lived comfortably in spite of what he has saved."

"YES, SIR," added Mr. Fowler, "Clark is a fine example of the man who planned his first fifteen business years in such a way that he is already independent and bids fair to become one of our wealthy men.

Then there is Martin Wood, assistant auditor in the same Company with Clark. You remember when Martin moved here from New England. He wasn't cut out to be a big executive. But he sure is a true

How Herbert Clark Gained Financial Independence in 15 Years

sample of New England stock. Only draws \$75 a week today, but his home is bought and paid for, he has a snug savings account for emergencies, \$10,-000 life insurance paid up, 50 building and loan shares fully paid for, and he is now buying first mortgage bonds on \$50 monthly payments. He has over \$2,000 in bonds already laid

Martin Wood is the type of man who will always be on a salary, and as he grows old the chances are his personal earnings will decrease. But already he is prepared for that time-His income from savings will more than offset any decline in earnings. The money he has laid away brings in over \$700 a year in interest, but nore of this is spent. It goes right back into safe investments, together with \$50 a month out of Martin's salary.

The other day I ran across a good plan for a young man. It calls for gradually increased investment, corresponding to increased earnings. This plan was put out by a house which sells 6% mortgage bonds. Here are the figures:

\$10 a month for 21/2 years, with interest reinvested amounts to about \$325. Then \$25 a month for the next 21/2 years brings the total up to over \$1,250. After that \$50 a month for 5 years increases the fund to nearly \$5,000. Finally \$100 a month for 5 years and the investor is worth pracrically \$12,700."

"I wish more men knew about these figures," said the Cashier. "How few men have \$12,000 after working biteen

"Yes," concluded Mr. Fowler, "and how many men could accumulate that much, and more, if they only adopted a hiteen-year plan and stuck to it."

"The trouble is, few men look at the business of getting ahead in the right way. Fifteen years seems like such a long time. It is in a way. But the average man has thirty-five or forty years in which to work and gain independence. And in fifteen of these years he can put himself in very comfortable circumstances.

Booklets Like These Helped Herbert Clark Get Ahead

THE booklets reviewed below will assist any investor to get ahead hoancially. You may obtain any of them, without charge from the housing house, by writing the Financial Department of Popular Science Monthly, 250 Fourth Avenue, New York For convensence ask for them by number as given below.

- 11 "How to BUILD AN INDEPENDENT INCOME (The F. H. Smith Company) presents a modern way of saving money, explains how first moregage bands may be purchased by monthly deposits, and presents tables showing results attainable by carrying out their plan for a period of years.
- [2] "DIVERSIFICATION AND VIGILANCE" (A. B. Leach & Co.) presents a brief analysis of seven basic principles that assure success in the management of personal investments.
- (1) "INCREASE YOUR INCOME 15% to 60%" (The Adair Realty & True Co.) explains how the investor can get 614% on money now earning 4% or 3%, on guaranteed mortgage boods.
- [4] "FORTY-FOUR YEARS WITHOUT LOSS TO AMY Investor" (S. W. Stratte & Co.) presents the safety record of this house and describes the safeguards constituting the Straus Plan-
- [5] "SAPE BONDS FOR INVESTMENT" (Halsey, Stuart & Co.) presents their current list of diversified investment offerings, with instructive investment comment.
- [6] "THE MAKING OF A GOOD INVESTMENT," published by the United States Mortgage Bond Company, explains the methods employed by that firm in originating first mortgage bond saues which pay 60% with principal and inter-

est guaranteed, or 61/2% without the guarantee, which is optional with the tovestor.

- "HOW TO GROW AND HARVEST DOLLARS" (H. O. Stone & Co.) describes a savings investment plan offered by that Company, and describes how to accumulate from \$4,603.25 to \$46,032.47 by monthly investment of from Sto-
- [8] "AN INVESTMENT INSURED FOR ITS LUTTINE" (Moragage Security Company of America) describes their plan of insured mortgage investments. Nine points of safety are explained.
- [9] "RULES FOR SAME DEVERTHERING" (Published by American Bond & Mortgage Company) explains in language that the layman can understand the importion forms of safety of real estate
- [10] "BUYING BONDS BY MAIL" (A. C. Allyn and Company) explains how the investor may safely and conveniently deal with an investment banker through the mails, and without the usual advantage of direct contact.
- [11] "Youn Moserr" (Fidelity Bond and Morygage Co.) covers the points of general interest to the investor who is planning to put his money in sound marrgage bond investments.
- [11] "The Schwer or Fortum Bergmen," published by George M. Forman & Company, is the explanation of practical, tested plans employed by investors to attain financial independ-
- [13] "Investors" Guros," published by Greenebaum Sons Investment Company, combines a description of bank safeguarded boods with an outline of the service of that company.



211 Different Kinds of Industries

St. Louis has factories in 211 different kinds of business. Almost every line of manufacture is represented. Only eight percent of the city's industrial force is employed in its largest branch of industry.

This wide diversity of industries acts as a constant balance and makes St. Louis strong in times of business depression. It assures stability of labor and production.

There is a westward trend of industry. Modern business is moving toward the center of the This has recountry. sulted in 196 new industries coming to St. Louis in the last six years. The central location of St. Louis makes it an economical distribution point. Your factory in St. Louis would have a distinct advantage over competitors not so favorably located.

Send for our booklet. "Why St. Louis Grown."
It tells the full story, Address Dept. 32



CHAMBER OF COMMERCE STROUGH, U.S.A.



THE BETPEMBLY
sensitive instruments
shown in this illustration are used to
decermine with scientific accuracy the operating characteristics of the trickle "A"
charger under test

SOLVING YOUR A-BATTERY PROBLEMS with a Trickle Charger

It is but natural that the development of radio receiving sets—in themselves capable of consistently reliable and trouble-free operation—should be followed by a concentrated attempt of manufacturers to provide the radio public with accessories that will insure the proper operation of these receivers with a minimum of replacement and attention.

For the vacuum tube plate supply, the user now has available the choice of much longer-lived dry batteries, more accurately rated and less trouble-some storage B-batteries, and electric-power adapting devices that very nearly approach the ideal characteristics of batteries without requiring replacement or recharging.

The problem of obtaining an equally reliable vacuum tube filament supply seems at this time best solved by augmenting the storage battery with a continuously charging trickle charger, or with self-contained A-power devices that incorporate a low capacity storage battery with some arrangement of automatically controlled intermittent or continuous charger.

All of the trickle chargers approved by the Popular Science Institute of Standards should prove very satisfactory in insuring an ever ready Apower supply when used in conjunction with storage batteries and when connected as recommended by their respective manufacturers, because such trickle chargers have been found by Institute laboratory tests to possess—

1. A sufficient charging rate to provide for all normal filament current consumption. This is essential if the

COLLINS P. BLISS, M.A.

Popular Science Institute of Standards

battery is to be kept in fully charged and efficient condition, always—the chief reason for using a charger of the trickle type.

2. Inherent taparing action or manual control of charging rate to provide against excessive overcharging. As the battery becomes nearly charged, it requires less current to complete the charging and provision must be made for this either by an automatic cutting down of current when the battery reaches a certain point or by an adjustment that makes possible the controlling of the charging rate.

3. Reasonable efficiency to insure

conomical operation. The ratio between the amount of current consumed by the charger and the amount delivered to the battery must not exceed that fixed by the Popular Science Institute as being economical.

 Zero or negligible leakage when power is off to prevent discharge of battery or failure of power supply or opening connection to charger.

5. Long life of operation elements to insure a minimum of attention. Electrodes that are affected by the acid solution or, in the bulb type of charger, tubes that are not long-lived have been the cause of some trickle chargers being disapproved by the Institute.

6. Substantial construction to insure long life and ability to withstand normal abuse.

Proper design to minimize fire and electrical hazards.

TESTS to determine these seven allessential points cover several weeks
and require elaborate testing equipment. The trickle charger is hooked
up in the regular way, according to
the manufacturer's instructions. A
number of very accurate instruments
are then inserted into the circuit to
determine both the initial operating
characteristics of the charger and its
behavior over the entire period of
test.

Readers who are considering investing in a trickle charger can secure a list of those approved—as well as other radio and tool equipment—by writing to the Popular Science Institute, 250 Fourth Ave., New York, N. Y.

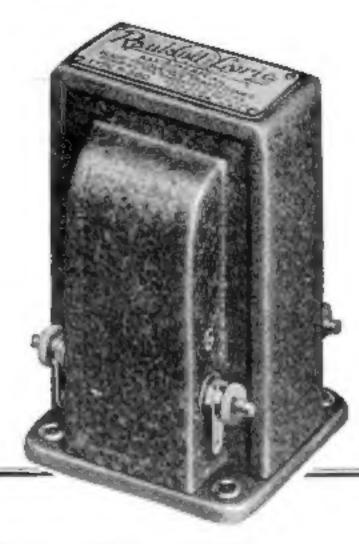
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Popular Science Monthly GUARANTEE

The above real on an advertisement indicates that the products referred to have been approved after rest by the Popular Science Institute of Standards.

Popular Scince Moorely guarantees every article of merchandise advertised in its columns. Readers who buy produces advertised in Popular Scince Moorely may expect their to give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Scinces Moorely. The Popularies

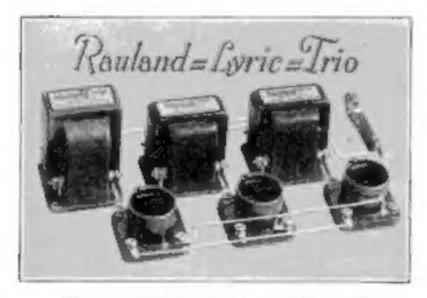
Still the undisputed leader Rauland=Lyric



If you love music, and want your radio set to reproduce tones faultlersly, there is one audio transformer you can absolutely depend on-the famous Rauland-Lyric.

Voices and instruments alike are amplified with amazing realness by the Rauland-Lyric; with faithful amplification of those "overtones" essential to full, natural reproduction. The amplification curve of the Rauland-Lyric illustrates its outstanding superiority in tone purity.

The Rauland-Lyric is the undisputed leader in its field. It is invariably chosen by set builders who want the utmost in perfect tone quality.



Write for "Modern Andio Amplification" a free book, describing this fine wait.

A new high mark in three-stage audio amplifiers

Your receiver's tone quality depends in large measure on correct audio amplification. The famous Rauland-Lyric Transformer may now he combined with two Rauland-Trios (impedance units) to form the Rauland-Lyric-Trio -the highest known perfection in three-stage audio amplification. Rauland-Trio is a compact, well-made unit - containing in one shell - inductance, resistance, and capacity in correctly balanced relation.

New 1927 Radio Key Book

You'll enjoy reading it -48 pages of interesting, up-to-the-minute facts about radio, simply told. Also full construction details of all leading types of circuits. Send 10 cents (coin or stamps) to cover postage and mailing cost.



ALL-AMERICAN RADIO CORPORATION

4205 Belmont Avenue, Chicago, Illinois

OPERATING STATION OWNING AND

266 METERS のどうのいっというとうのいっというとうのとうのとうのとう



The Synchrophase is also supplied with battery base and in five heastiful console models.

THAT ideal set you are looking for or contemplate buying — do your tests show that it has been fully developed in

Tone Quality?

Extreme Selectivity?

Station Coverage?

Easy, Accurate Tuning?
Simplicity of Control?
Durable Construction?

Test it for these qualities; then test the Synchrophase. Compare. Be exacting.

See a Grebe dealer today.

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A. H. Grebe & Co., Inc., 109 West 57th St., New York Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

This Company owns and operates stations WAHG and WBOQ



All Grebe apparatus is covered by perents granted and pending.





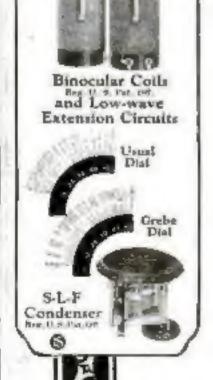
"Make conscientiousness and sincerity your first principles."

- Confucius.

These are the principles behind the success of the Synchrophese.



Cayrofiled insertal.



Colortone



POPULAR SCIENCE MONTHLY

SUMNER N. BLOSSOM, Editor December, 1926



"CAVE-IN!"

By
Edgar C. Wheeler

A Stranger-Than-Fiction Story of Forty-Three Miners Who Were Rescued from Living Death

T WAS noon on the fifth day of the recent Ironwood, Michigan, mine cave-in. For almost a week forty-three miners of Tom Trewartha's ging had been trapped like rate in a hole, 720 feet down. Two cave-ins—tons of bouklers and diet tumbing down the main shaft of the Oliver iron miner—bad blockaded the shaft above and below tiem. All the resources, men and materials of the world's most famous from mining district were concentrated on the desperate task of rescue.

In dripping blackness two thousand

feet below the surface, a wiry figure in rubber coat and boots was wriggling through a narrow burrow which had been dug upward from the twenty-fourth level. The man was George Hawes of Chicago, safety expert and volunteer rescues. At his heels were two others—Oscar Olson. chief engancer of the mine, and Capt. Gest Erickson nune superintensient. I lese three were working on the daring plan of reaching the improened men from the bottom upward They had made their way into the depths of the wrecked shaft by conneeting passageways from another shaft close by. Resourceful and skdful men they were, all three.

Where the mole-like burrow now opened into the main shalt was a hole through waich a man's body could barely pass. Haves, sim and agaic, led the way Squirming and twisting between jagged rocks, he forced but body through Somewhere, a thousand feet above him in the abysmal well, lay the living tomb of the forty-three. Could be camb up through the treacherous blackness and reach them?

WATER seeping from above splashed down in a cascade and drenched him. With chilled hands he clutched the rungs of a saider that ran up one side of the shaft. The ladder was broken! By the light of his lamp he mended it with dangling cables and power lines that had been cut by falling debris. Cautiously, a foot at a time, he pulled himself upward, knowing that

at any moment a false move might start tons of rock northing upon him.

The other two followed. I p a hundred feet now, they had reached the seven-teenth level. Only the trickle of water down the shaft broke the ghastly silence. However thousand, No answer from above

"We'll lry to egnal them," he and "If they're abve they'll answer," With a miner's hammer he supped on a water pipe that run up through the shaft. One—two—three—seventeen blows.

"If they hear that, maybe they'll guess it means we're on the seventeenth level."

After the Rescue

Dared and haggers from the abock of their fiveday entombrient wome of the forty three fromwood. Machigan, maters as they entered the firstaid our following their initiaculous escape. Once more accountage rescut methods had chested death he said. He wasted. There was no reply "Nothing to do but keep on said. Hawes. "The pipe may be broken above us. Let a go

AGAIN he led the way up—as perdons a climb as ever burian being at tempted. Far above, the great shaft was stall blocked with boulders. A single labe step lought distolge enough to bury the rescuers. New and again a break is the ladder forced a laft while they improvined rope ladders to bridge the gap.

Past the sixteenth, fifteenth, fourteenth levels, clutching and groping for a hold. The clutch seemed endless. Now they approached the thateenth.

"Look!" Obser auddenly erred. A merce's dinner park, caught on the rocks, where it had falsen when the wails eased. It aught mean anything or nothing.

Again Hawes rapped the pipe will in his hammer. One—two—three three three counts. A panse. Then, clearly and distinct y a tap in reply Another! One—two—three—four—five—six—seven—eight!

"They readive" he exist "They're signaling as from the eighth level! "Again he tapped "thirteen and again came the answering "eight. "Thank God!" and Olson

SO FAR they had climbed five bundred feet, there was another five hundred feet to go, bomenow they did it pulling their decided and wears bedies upward as hey net, twisting and groping and contching.

Heilo! A voice, the light of a miner's lamp, a figure a linusetted against rock, and in another second Hawes bey hand was seized in the iron grap of Tom Trewartha, who slood, a centry, at the entrance to the eighth level.

"We're all safe," were the first words of Trewarths. Two miners stood beside him. "The other farty are a thousand feet back in the level, asleen."

He led the way into the cavern, arousing his men with a shout, Wild with joy and rehef, they crowded



Scene of the Disaster

View of Ironwood maning dutries. The "G" shaft, where the cave is occurred, is in the middle distance. Beyond to the "H" shaft up which the miners excepted

about the rescuer, lugging him and pounding him on the back. They showed line about their prison and described how they had lived for five terrible days.

Trewarths, they said, had saved them from their greatest peril, the peril of despair and madeess, by making them work. Drinking water they had found coursing down the mine runways. Their only food, after the scraps in their dinner pails were gone, had been birch ten made from bark peeled from tunber props, brawed in a tobacco can. One man famished, had devoured three cornects pipes. The taste of tobacco was in them," he said, "and I wanted a smoke."

Luckely, for light and fuel, they had found a dram of carbide for acetylene lamps, and a five-gallon can of kerosene. For encouragement, they had listened to the distant rumblings of rescuera' blants, to the grinding of the diamond drill, and lind sing songs.

What they wanted most now was something to est—and a smoke. Haves fished down in his pocket and found a lone, battered eigar. He passed it around. They took turns pulling it.

EVERYONE recalls the thirding rescue work that continued throughout that autimo afternoon and far into the night

how the firmsy ladders were repaired and strengthened, the emergency tunnel wilened and braced, how nourishment and "smokes" were carried in to the forty-three famished prisoners; and then how, one by one, they were assisted down the perilous ladders and through winding passages to the bottom of the adjacent shaft, where they were lifted in mine cages to safety. The whole nation rejoiced with the relatives and friends who trowded about the mine entrance to cheer their men as they came from the depths.

One chapter of that story, however,

that most of us could only guess, has never been told. It was the wonderful part played by scientific and engineering genius in making possible one of the most remarkable and difficult rescues in mining history.

Here was a suiden emergency that demanded the use of every precious second. It challenged the effectiveness of scientific training in nume rescue work first undertaken nearly twenty years ago by Uncle Sam's Bureau of Mines. That the rescue was completed so thoroughly

was due not only to the heroson of individuals who risked their lives, but to the fact that in the awift concentration of engineering skill not one plan miscarried.

IF YOU could visit one of the iron mines in the Lake Superior region and go down in a cage in one of the well-like shafts, you would realize something of the tremendous odds which faced the rescuers that Friday noon when the first alarm of the cave-in was brought to the mine engovern. You would find bronwood, once a rough mining camp, now a city of 15,000 sours, nestled ut the hills of the famous Gogebic range, for years the richest source of high grade from OFF

About a nule beyond the unpaved ore-tinted streets of Ironwood's business renter, you would come upon the Pabst mines of the Oliver Iron Company, the largest in the district.



George Hawes, volunteer rescaler and safety capter, who, with two others, made the perilous climb leading to the prisoners

Framework housing towers, rising from the hills, mark the entrances to mine shafts.

Then, if you inquired where the rescue occurred, you would be directed to the "6" shaft the main shaft of the workings. Thus, like its neighbors, is simply a huge burrow dug into the hill. It goes down to a depth of 2600 feet, or nearly half a mile. Unlike an ordinary well, however, it slants at an incline of about seventy degrees. The sides of the shaft are heavily ribbed and braced with planking and steel girders to withstand the tremendous pressure of rock.

AT INTERVALS of about 100 feet downward there extend from the shaft berinoutal passages like the branches of a tree. These are the levels

hach level bears a number, the numbers increasing in order as the depth increases. Thus the second level is near the top of the shaft, while the twenty-such level is at the bottom. From each level, in toric bear in still, singler timels called drifts. In these drifts the miners work, digging out the ore, which is loaded into cars and transported along the level to the shaft

I p and down through the shaft, bke the elevator in a sayscraper, runs the "cage" which carries the inners to and from their work on the various levels and which housts the loaded skips of ore to the surface. It runs on tracks and is fastened to a cable from a housting engine above the surface.

On one side of the "G" shaft, about a quarter of a mile distant another shaft of the Pabot more pierces the earth. It is known as the "H" shaft. Some of its levels connect with corresponding levels of the G. On the other side, at about the same distance, is a third shaft known as the "F" shaft of the Aurora intic. Between this and the "G" shaft is an old abandoned. G. shaft of the Pubsi.

werkings—buch was the bewildering not lidl of tranels and passages that confronted the rescuers on the day of the disaster.

Tile first miding of trouble came ball an hour before the noon whatle on Friday, when the housing engineer at the "6" shaft became suddenly aware that the caple auspending the cage had failed slack. Something had gone wrong. Only a few minutes before, three men, an electrician and two helpers, had gone down in toat cage.

Quickly one of the slope used for hoisting ore was lowered. Before it reached the eighth level it stopped abruptly; and when the hoisting engine tried to lift it out again, the cable anapped. The skip was buried. The meaning was all too plain—a cave-in!

Instantly warnings were flashed to the miners working on the various levels below. They escaped

through the levels leading into the "H" shaft all but forty see. Of these, three had been hurled to probable death in the cage; the remaining forty-three were trapped in a walled dangeon of rock.

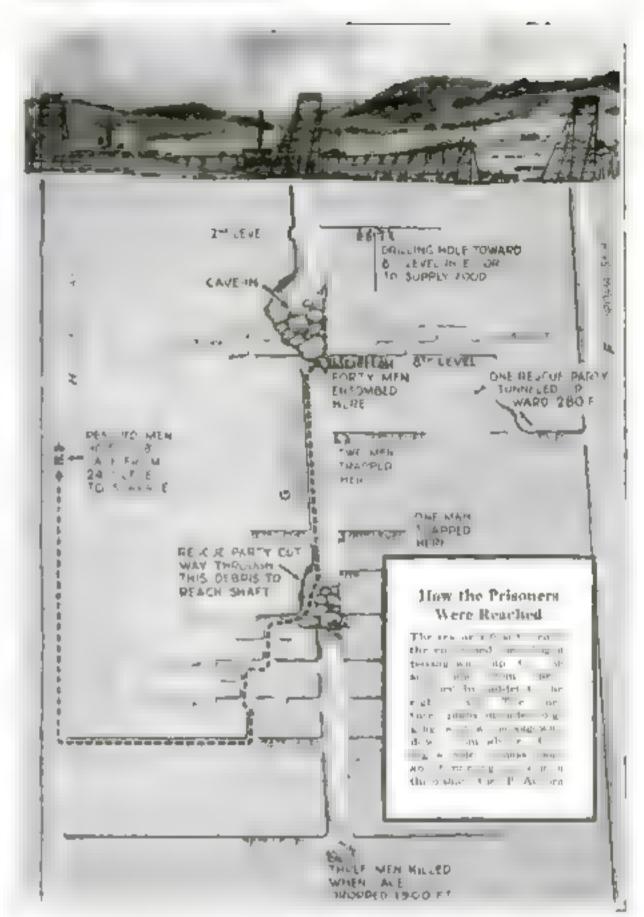
The extent of the tragedy now was revealed. Something it in ght have been the effect of an earthquake months before, or of recent heavy rains, or the jurning of a derailed mine car—had dislocked a buge boulder. Tearing through the shaft wall, the great rock had plunged downward, crashing at the eighth level into the cage and breaking it loose from its cable. The cage with its minian cargo had hirrlied 1900 feet to the bottom of the shaft, followed by a shower of boulders. The paunding of the boulders had caused the two cave-ins, one at the eighth level, the other at the twenty-first

BETWEEN these two walls of debris were unpresented the forty-three. Of these, forty were miners at work on the eighth level under the shift boss. Tom Trewarths. The other three were shaft inspectors, known in the nine as "road names es," two on the thirteenth level and one on the eighteenth.

Light wires, telephone wires and water pipes running through the shaft had been broken by the delage. The entombed men were completely cut off from communication. Their only supply of food was what was left in their dinner pails. Trewarths was a boss of known courage and resourcefulness, with thirty nine years of experience in the mare. He could be marted on Yet, even with such a



"Cautiously a foot at a bene. However, pulled himself apword. One false move might start term hurtling down. Only a trickle of water broke the ghostly plence. He shouted. No answer from above."



leader how long could they hold out up the battle with hunger and manness?

It was a task that called for expert engineering and perfect teamwork. Within a few hours the entire district was transformed from an industrial enterprise into an organized arms of rescue. Work in other mines ceased. More than three thousand men volunteered to risk their lives. The shift bosses bined up their men, and from them picked those who could be depended upon to stand up under the terrific punishment of driving physical labor. In all, about 300 were chosen. They were the "shock troops. Every man of them possessed working knowledge of mine engineering

The scheme of attack was four-foldfirst, to due a new passage down through the mass of debris that blocked the shaft between the second and eighth levels, second, to drill a two-and-one-half inch bole straight down from the second to the eighth level, through which food might be passed and communication established, third, to due an upward tunnel, or "raise, from the thirtienth level of the adjacent turors "F" shaft to the eighth level which held the prisoners, and finally, from the depths of the "G" shaft, to bore other "raises" apward from the twenty fourth level paradeling the main shaft, and so pass around the lower cave-in It was this last pion of working from the bottom up, the most difficult of all, that in the end succeeded

WHILE these plans were being everenced, the first rescue squads, armed with acetylene cutting torches, were burrying to the bottom of the wrecked shaft where the cage with its three passengers had plunged. Descending by way of the "H" shaft, they gruped across the twenty-sorth level until they came upon a shapeless and twisted mass of iron, half covered by diet and rocks. No hope of any man's surviving that awful crash. With torches the rescuence through the tangled metal until, at midnight, they recovered the bodies of their three (continued on page 129)

"It's Brains Against A Famous Big Game Hunter Gapture the "Beast By FRANK

They Captured Eight Gorillas-Aliva

Ben Burbridge, noted American big game hunter on his two has expeditions to Africa cagnited more live got that then any other naturalist, eight in all, and has brought to America the only living gottle outside of Africa. Burbridge is shown above with the little band of Pygmy warriors who formed his busing party.

O. BWANA, we will not go with you after the gorilla. On the trad of the lan and the elephant, yes see will follow where you lead. We will stand by you whate you kill the chanceros and the buffalo. But the Man-of-the-Mountains is crafty. Even the hou and the elephant shin the forests where he lives. We are afraid. We will not go with you to the Mountains of the Moon."

The all but naked "headman" delivered his obtimation. The black honters and warnors grouped behind him modded in confirmation.

"We will not go; we are afraid of the

gorilla," they chorused.

The lean, leather-tanned white man shood up to address them. Alone, save for his train of native bearers, he had come more than two thousand miles into the heart of Africa with a single purpose. Here, on the edge of the land of the Premier, he was almost within night of hes goal. Eastward, towering above Lake Arva, rose the volcame peaks of the Arcunga mountains, and in the forests which fined their slopes fived the mysterious man beasts, the gordas. To study and photograph them and if possible to capture them, he had crossed the Atlantic, steamed up the Congo river to the head of navigation, then followed the equator eastward through weary weeks, only to have his sofari halk when its members had hearned his true errand.

OFFERS of three, six, a dozen times their regular pay for hunting trips had failed to move them. At last, by bribery and persuasion, he had induced the chief of one of the local tribes to bring his best hunters and bravest warners before him. Now they, too, refused to go into the gorilla country.

"What are you alraid of?" the white man demanded, speaking in the Swaloli tongue, which is currently understood throughout equatorial Africa whatever the tribal language may be. "What are you afruid of? The gorilla will not harm a man."

He tried to make his tone convincing. He might have succeeded with some groups of natives, but not with these. They knew better. The chief arose and came forward. Beside him

this man."

imped a man who could scarcely walk.
"The white man says the gorila will not attack men," said the chief. "Look at

The lame one turned around and showed his back. Great chunks had been tern from his shoulders by the teeth of some wild brast. His knee was so twisted that be could never again straighten his leg.

leg.
"A gordin did that," the chief explained. "This man was cutting building in the forest when the Harry-one-who-hyes-in the-bills attacked him."

HE TURNED and stalked away, her warmers following, back to their

village of huts.

Ben Burbridge, the gorilla sceker, was not daunted by this second setback. He was too experienced a hunter, both in America and Africa, for that, For twenty five years this retired real estate man of Jacksonville, Florida, has been chasing hig game of every variety between Alaska and Memon and all over Africa. But when the stalking of lions and elephants, Kadiak bears and jaguars, rhinos and buffalo, grizzlies and mountain bons began to be an old experience, he turned to new adventures which proved

The Only Gorilla in Captivity

Miss Congo, six year-old gorlife brought by Burbridge from Africa, with her factor mother, Mrs. J. D. Surfittings, along in law of the explorer. In this article Surfittings tells of the ingentous rune he had to employ to expensive the young gorlife from her purents

the most exciting in his whole career as a femiler. The chase and raptire of the gorida

R. BURBRIDGE in his two latest expeditions to Mesca, not only obtained the only motion pictures ever made of the gorilla in its native haunts, but captured more live gorillas than have ever fallen prey to any other naturalist, eight in all. He succeeded in bring by three back to Europe and America alove, one of which, a female about six years old, has I ved and theired since the fall of 1925 in Florida and has furn shed to scientists the first real opportunity to study the mentality of the beast which both structurally and in reasoning powers, resembles man most closely.

In the eighty years since a missionary found the skull of a gornla and time part y confirmed the truth of ancient travelers tales of a race of huge, manbke creatures who terrified their enemies by dramming upon their chests with their hands, not more than a dozen or so live specimens have ever been brought out of Africa, and only three of those were ever brought across the Atlantic to America. Most of them were tany infants, of which only two fived more than a few days or weeks. Miss Congo, in her five-oak tree on the banks of the St. Johns River, is the only

Brains—Fighting Gorillas!"

Tells of Tricks He Devised to That Fights Like a Man"

PARKER STOCKBRIDGE

bying gozila today outside of the African forests. And up to 1905 there is no record of more than one gozilla ever having been shot by a white hunter; it is possible that not more than twenty white men have ever even seen a live foll grown member of this strange race.

INDEED, up to a bare half century ago the very existence of the gurilla was oscioled or deneed by many scientific tien, although the invisterious beasts were lescribed and the name by which they are still known was given to them five handred years before the Christian era. Harno, a Pincent on payigator, sailed southward away the African coast about the year 500 ar. In the revers of his travers, Harno describes a strange tribe of anary people" whose appearance and custome tally with what is known of the gorilla today.

Then, for more than 2000 years the whote world heard no more of the gordia to bloom 1500, an English as for Austrew Battel came nome from an African yearing with the same tale Harris had told. The gordia was still a functial legend, however, until the docuvery of a skull in 1856, of a complete skeleton in 1851, and of a stor, brought in to a missionary



A Test of Intelligence

Must Congo showing the accentrate that she can use her head to reach an orange—she piled the boxes up herself. Burbridge's capture of Miss Congo is giving scientists their first real opportunity to study the mentality of a gorilla settlement by a native in

But when Paul du Charltu. the American explorer, pubhshed in 1801 an account of hat African journey in which he described the gorillo and ets habits in detail and in the same volume told of a race of Pygmies, smallest of all hunums, who lived in the forests. near the gordin country, the yarn was too fantastic to be believed. The sejentists of that day might have stood for the gordin slane, but they could not swallow the Pvg nis! So do Chailly was branded as a light and the gorden as a myth along with the Pygimes until later explorers confirmed has accounts of both.

then Burbridge, latest of these explorers, has not only recorded the life of the Pygmes in motion pictures, but he has penetrated deeper into the thick mountain forests where the Kivin gordlastice than any whole man had gone before What he learned about the man-beasts and their way of living he has fold graphically in a motion picture film entitled "Burbridge's African Corolla Hunt," just released as this is written And one of the things he learned is that the natives who told bun gordlas would attack humans were right

I didn't intend to kill any gorillas? Mr Burbridge told me. but I did kill three, each time in self-defense as the beasts charged me. They charged many times, in fact, as I was making motion pertures of them, but usually I succeeded, with the help of my gun bearers, in frightening them off by a fundance over their heads.

"Yes," he went on resulting his story from the beginning. "I finally succeeded in getting a sufficient number of natives, who were not too familiar with the ways of the gornla, to make up my safer into the mountains.

"WHAT I was after was live, young gornlas. In order to hunt them at all one has to have permission from the Belgian government, since they are found hamily anywhere except in the Belgian Congo. The permit that I had authorized me to bring out four captives on each of my two expeditions, provided I gave one of each four to the Antwerp Zoological Gardens.

"Our method was to watch for a family of gordlas passing through the forest, the old male leading and the young ones straggling along behind, and to pick up the straggling infants. It was not so easy



The Boast That Fights with Brains Burbridge a helper ground out this starting camera picture as the great gar as rushed at the explorer

as it sounds, and it was decidedly unsafe if the parents missed the youngsters before we were out of harm's way

"The gordle fears nothing when its young are in danger. The flesh-eating beasts seem to know that, and give the gordle forests a wide beeth

THE only maranding beast which ventures into their haunts in the leopard, the stealtheast of all the eat tribe. The leopard is very fond of the flesh of baby gorillas and frequently manages to sense one and get away with it Sometimes, however, the gorilla catches the leopard. A chief told me of hearing a commotion in the jungle one night, in which the rose of a gorilla and the scream of a leopard were unighed. In the morn og he found a dead leopard, which had been literally toen to pieces.

"I had to devise many methods of exciting the curronty or anger of the gordina to get them to show themselves where they could be photographed, or to enable me to capture the young ones. The most successful was to instain the snarl of a ropard their change position rapidly when the mother gordin charged in the direction of the sound separating herself from her young. I would hold her attention as long as I could in that way while my helpers snatched at the halfs gordins and scutted away to safety with them

One day we caught two young gordlas in this way. We thought the rest had gone on, and had begun our march campward, when I heard the roar of a gordla behind me. I know of nothing more terrilying than the roar of a gordla when heard for the first time. It rivals the roar of a hound no volume, but has a more threatening tone. It is punctuated, moreover, by the beating of the heast's arms against his chest, producing (Continued on page 132)



Carring may Taurn in the new humane way. Dr. R. M. House, proposent of the famous "truth serum," is shown above making a truth test at Windsor, Canada. The subject is placed in a rectaining position and his eyes see handeged in order to protect them against the light. as scopulamin, the "serum" used, dilates the pupils like belladoons.



Recognise Means Pursaymens, the picthynomyraph above beirays the emotional startisms of suspected persons when they are suddenly confronted with objects related to the cross. Its covenius O. R. Salubury of Rochester, N. V. is shown in the Glumpation above taking the chart from the cold of the end of a test

Strange New CRIME Remedies

A Discussion of Amazing Devices That Test Skin, Eyes and Heartbeats to Detect the Guilty and Protect the Innocent

AMERICA or being disgraced by crops. The crops "wave has be-

In there a remedy for this national disgrace? I believe there is, and that science can help to supply it. The remedy is more prompt and certain conviction of the criminal. Science can and this through the methods of practical psychology that reveal the innermost workings of the housan mind.

Consider for example, the case of Andrew Toth, about which I resently read. On New Year's Day 1891 an aged watchman, Michael Quant, was associated in the male at Brud-lock, Pennsylvaria, and killed. Andrew Toth was arrested. While he was being examined one of the men in the room fell over a cuspoher. Toth made the mistage of

laughing. The man who fell council described that he dent fied Toth as the person who had struck Quant. Toth was convicted and sentenced to be hanged, but this sentence was carmented to life topics or mental to the Toth who was in prison, or in Australia. On los deathbed he confessed to a priest that he not Andrew Toth, was the mordecer of Quant. Amirew was released, minus twenty years of his life.

I BELIEVE that a psychological examination, in the hards of experts, might have revealed much that would have helped the jury judge the credibility of the convicting witness. It at least could have established definitely whether Andrew Toth was the kind of man to be a killer.

By E. E. FREE

Psychology has made enormous studes in recent years. Tests have been devised to measure the characteristics of luminal beings, so that their individual traits, abilities and weaknesses become evident. The minds of bars, for example, have become better understood. These methods are being used in business and in ordistry. When taxicals drivers in Chicago were selected by psychological tests, the number of street accidents immediately decreased. Similar tests were used by Johnson O Connor to select employees for the General Electric Company, and the labor turnover fell markedly.

These same psychological tests can be

used as several remarkable recent develsoments have shown to study commutaand to extract the truth from a tnesses. This is a logical next step in the application of setence to problems of crime. Most large police departments accordy possesu chemical experts who test bloodstains, intermediately expects who photograph the marks on a bullet and tell what gun it cause from. These achievements are notable and useful, but they deal only with currentistantial evidence. Science most now deal with the human evidence also; for the law mousts rightly enough that homan evideore always takes precedence over circumstantial.

There are two ways in which psychological science can help detect crime. One is by helping to determine when a sesses are tell in the truth and when the arelying. If nother is by eliminat-

ing from a list of suspected persons those for whom that particular crime would be a psychological impossibility.

O'vE way to accomplish the first of these is by means of the much discussed the detectors, which show, automatically say attempt of a witness to be Some of these instruments record the heartbeats of the witness. A device sattached to the witness's arm or chest. The witness then is saked questions about what he is supposed to know, or is slown objects related to the crime and which might arouse telltale emotions which the hearthest apparatus would register. The strain and excitement of trying to he usually causes a quickening of the



In the White Glare of Truth

Suspects being questioned by the "shadow boa" method recently introduced in Len Angeles. They are walked onto a stage and powerful lights focused upon them so that while they can see no one, detectives can study them as they wish while they assure questions. Another instrument, devised by Dr. W. H. Bates, an occulet of New York, measures the exact shape of the witness's eyebull from moment to moment. Dr. Bates has found that lying may create a boddly strain which tightens the muscles around the eye, and afters the shape of the eyeball. His instrument detects the alteration.

A test of guilt or innocence which the psychological criminologists have found to be even more relative depends on another boddy reaction which apparently is absolutely beyond the control of the subject. This is the electric resistance of the ikus.

The facts upon which this test is based have been known to psychologists ever more the discoveries of Dr. Charles Fere in Paris, in 1887. That savant proved that the electric resistance of the skin afters whenever the subject experiences at a emotion. Many "be detectors and "emotion detectors" have been constructed on this principle. The most recent and successful one I know of a that devised by a New York psychologist. Dr. David Wechsler.

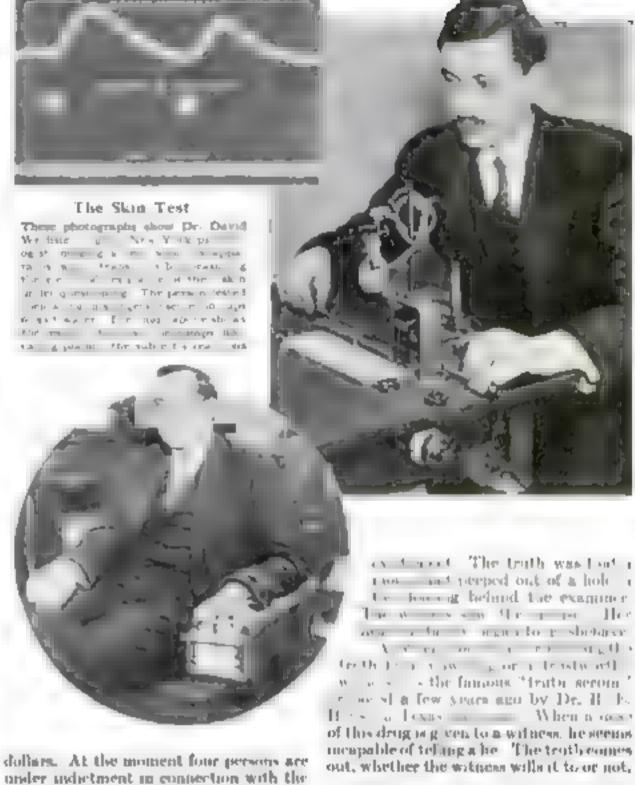
The apparatus is simple. The person to be examined ups two fingers into suity water in small porcelain jars. These provide the electric contacts. A small current, too feeble to be felt, is passed between the two jars and through the fingers. Meters connected with this circuit measure the resistance of the skin.

I sat recently in Dr. Weehsler's laboratory and dipped my own fingers rate the two small cups. Dr. Weeksler adjusted the ercents and read the resistance of my skin. a figure which varies for different people and even for the same person at different times. This adjustment made, Dr. Weensler suddenly reached over and pinetied my chin. Instantly the light spot slessing the reading of the galvanometer made a sharp jump across the chart.

The purch on the chin started off an emotional reaction, composed in part of surprise and in part of reaction to the mild pain. This emotional response greatly reduced the resistance of the skin. The same thing happened when Dr. Wechsler blew an automostic horn, when he spoke of something that interested me, or even when I conjunct up for inviself a mental image of mosting about which I was very purch concerned.

The alteration of the electrical reastance of the akin apparently is entirely independent of the will. Certainly it is so in my case, for the only effect which I produced by trying to prevent the motion of the galvanometer was to make that motion still greater and to make it happen more quickly. Certainly in most examinations of witnesses the device would provide an invaluable, and utterly inconscious, index of how fully the witness was emotiopady distorted from mament to moment during the examination.

AS I write this article, the State of New Jersey is in the midst of its second investigation of the famous Hall Mills nurder. Four years ago the Rev. F. W. Hall and Mrs. Eleanor Mills were found dead underneath a small apple tree outside the town of New Brimswick. Both had been shot. No one has been convicted, although the various investigations are repaired to have cost over two handred thousand.



dollars. At the moment four persons are under indictment in connection with the crime, the arrests having been made nearly four years after the murder

Throughout the history of this famous case it has been believed by victually everyone who has atodied it that at least five persons know more than they have been willing to tell. This ease would have been an excellent one in which to try some headetering device like that of Dr Wechsler. If one knew just which articles or questions were exciting and disturbing to the various witnesses, a theory of the erine would be easily found. The facts discovered psychologically might not actually solve the ray stery, but they would be sure to yield valuable chies.

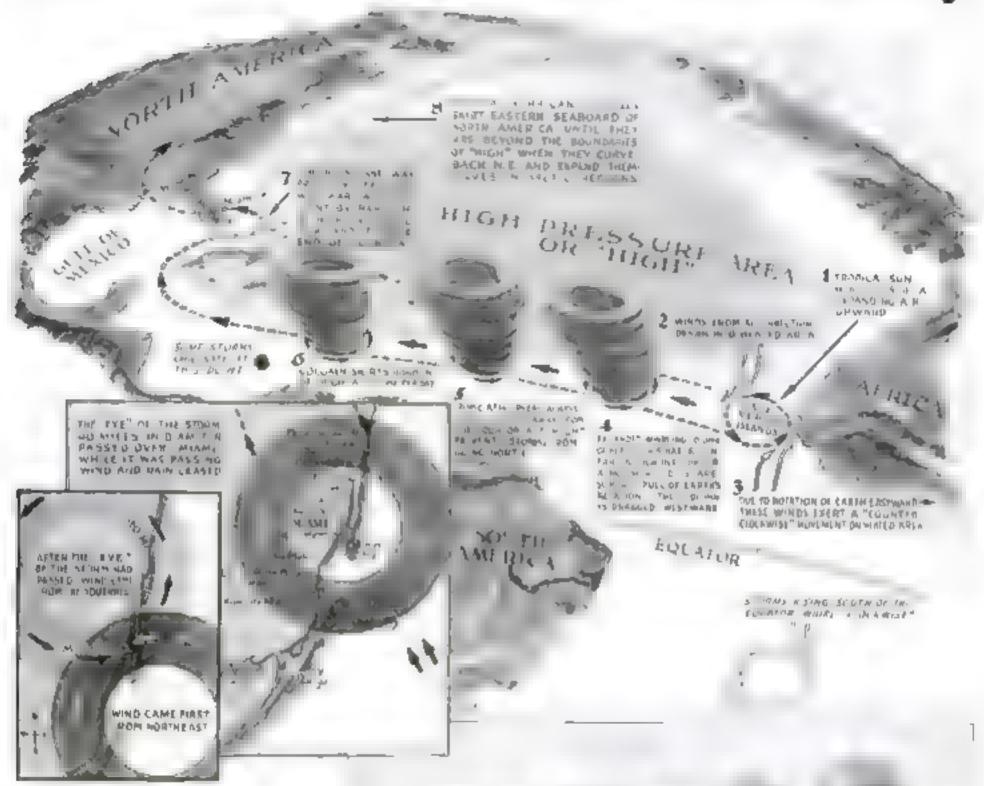
THIS emotional disturbance, while not, of course, a sure proof of guilt, is an important clue that can be followed up like any other clue. Like other clues, to be sure, it sometimes proves fruitless but in any event it provides a new basis. on which to sift the evidence of a crune. l remember, for example, one case in which a woman witness was being eminmed by a lie-detecting device depending on the heartbeat. She was shown articles related to the crime. She was asked questions, all of which were passed by or answered without a quiver of the maclone. Suddenly, at the sight of some article which turned out later to have nothing to do with the case at all, the indicators on the machine showed great

THIS is not really a "serom" at all, but a well-known deag, moved scopulation, long known to physicians and used in the famous "twilight sleep" much discussed a few years ago. One of the effects of this drug on the human must is to paralyze what psychologists call the 'censor, that continual watenfiness which guards everything you say and do and sees to it that you do not bright out, on the spor of the moment any fool shifting that happens to come into your head. In a sense, it paralyses the will, including the will to deceive

In New Orleans, three newspaper reporters took doses of the drug before the city medical society. They had agreed among themselves to try to be. But when questioned, under the influence of the drug, the list would not come. The truth came out pastend.

Of course, the three reporters were presumably men who were habitually truthful. Their natural impulses were to tril the truth. Many criminals are not like this. Either by nature or by long education and experience, hes come more easily to their than the truth. This is akely to affect their reactions to the Texas truth serum. Still when properly used and interpreted, and especially when admirestered according to the careful technique worked out by Dr. House, the deug may be a most important and to the discovery of truth. Like (Canonad on page 135)

How a Hurricane Gathers Fury



H'ind and Rain, Spinning Like Top at 100 Miles an Hour, H'reak Havoc

HORIDAS recent disaster serves as a grim remander of the ever-present danger in a country subject to harmones. Wound the last few years extension studies have been made of these conical stories and on this page our act est summarises pictorially some of our lately acquired knowledge of humounes and their habits, based on the work of Charles L. Mitchell of the U.S. Wenther Bureau.

The West Indian hurrienne, taking its name from the center of its native region, is not the largest of storms, being midway between the mild cyclonic storm of the temperate none and the havor-wreaking tornade. A full-fledged hurricane is a whirling mass of wind and rain from fifty to 200 miles in diameter, spinning at the furnish rate of a hundred miles an hour, with a partial vacuum in the center, and moving like a giant top creeping along a



Canno at Musto Beach, Florida, and wreckage of approach to million dollar pier after the recent burrycane. Stronger built buildings, expects say leaves damage when rycknes occur

smooth table at a rate of ten or fifteen miles an hour

It commences as a beated mass of most, stagmant air rising by its own lightness. An incipient hurniance north of the equator will draw winds from both north and south, where the edges of these two air streams meet, a whirlpool of air is set up, rotating in the opposite direction to the hands of a clock, as will all burricance porth of the equator.

August, September, and October are

the hurricane months. During that time conditions giving rise to hurricanes are just right in the doldrums, a region of calm air near the equator.

Since the universal equipment of vessels with radio, shipboard observers are able to keep the Weather Bureau constantly informed of the location and progress of hurricanes. Warnings are flashed to ships and the alarm is opread on land. Even a few hours' advance notice helps lessen the damage done.

What Science Knows About

Your Feet and Your Shoes

Vanity and Overtaxing Are Chief Causes of Common Ills

MOUR views ago, while supervising ■ the production of a motion picture, i. stayed for several weeks at the Athletic Club in St. Paul. Minnesota. There was a fine gymnassum there, and I welcomed the opportunity of "working out" on the track for a half hour each

morning. It had been years since I'd been able to do any regular athletic work, and as I started out the first morning the physical director warned, "Look out you don't overdo it'"

"Don't worry!" I told him. "Never felt better in nov I fe"

Heat pretty cocky My wind was surprisingly good. My heart was sound. I found I count run almost as easily as when I was at which Around and around the track I went Except tout my feet hurt, I seemed to be as good as ever

When I stopped rearing how ever, my feet kept right on herting When they contrasted to burt all day, and kept me awake that might, and kept right on burting the next day, I had plenty of time to realize that something was really wrong that the physical director's warring hadn't been so foolish after ad-

Pain is the poor foot's protest against abuse. Disregard that protest foo long, and the feet will upnt altogether. I wish somebody had told me this before I made that you. I've paid for my ignorance ever since with pain from fallor arches. I had not been doing a great deal of walking. Pounding around the hard-padded rinning track put orthie strain on the weakened arches of my feet, and they broke down-

When we went to war the medical examiners found that one man in every eight passed upon had fallen arches. And the "young male population" of the draft constituted the strongest class of men, physically, in the nation. Older men are far more likely to have fallen

arches or other foot troubles than young men. Among work en, defective feet are still more common, women are even prouder than men of having feet that are small and painful-

SO WE can estimate that at least one person out of every five or sex in this conatry is definitely suffering from weak or painful feet —in round nonhers, between 20,000,000 and 25,000,000.

And how those feet do hart! Aching feet have spoiled more lives than aching hearts.

As in my own case, undue strain is one of the cluef causes. of broken-down arches. The

By JOHN AMID

average man, conscious of his strength and good general health, thinks he can walk when and where he likes without bad effects. Take orders from his

own feet? He grouts the idea. As a

Ten Causes of Foot Trouble

- Sudden breakdown of foot muscles due to: unaccustomed use after long mactivity
- General assession to walking.
- Long hours of standing, as in cases of teachers, policemen and clerks.
- Objection trug fat people seem often enried. with small feet.
- 3. High heels persistently worn,
- 6. Any illness that leaves the body masseul. ened condition.
- . Local rejuries that cause but foot hidats, such as turning the foot to case a high
- 8. Shoe sale-people who don't know their
- 9. Incorrect walking "Toring out."
- Varioty is shedr compels at least half of no. to los shoes too short and tight, to create the this-ion that we have "small feet."

matter of fact, a single long walk, after months of comparative inactivity, can do arrows damage to your feet through breaking down arch muscles unarenstoned to such protracted strain.

Business men who play an occasional game of golf often fall victim to this danger. They feel that no harm will come from eighteen or even thirty-six holes of their favorite game on the one day a week they get a chause to play it. As a result, instead of lowering their acores, they frequently lower their archea.

A golf professional of my acquaintance who once overtaxed his feet in this way had to play for three years or specially made kid shoes with

modly boilt arches as a penalty. Feet can be broken down by overloading—fat men pleme note. Even well-developed, landened feet eun be broken down by being used beyoud their strength, or by long hours. Here's where policemen suffer, pounding the pavements all day or all might. Here is where elerks and sales neg and office emploteer a fer for standing on the feet is abnost as great a strain as walking on thrus. Nurses, too, know the agreemen that use of the foot beyong sta strength can give.

At TOMOBILES have adati-toted hard concrete or aspiralt surfaces for the uneven roads and foot paths of therty years ago. Thus is another cause of modern foot troubles. Rubber beels have given some react from the constant hammercia, but it has been only part mi

A maximi on foot care and correct shoe fitting prepared for officers of the L.S. Navy and L.S. Murine Corps, suy s

"The great major to of recruits received in the service for training are men who were formerly occupred in section to occupations ex-

eversing bittle or not at all and ridars wherever possible. This universal aversion to walking is typical of the main of today who surrous and to mechanical conveniences of all types saves Jumself the effort and takes the path of least resistnace. This type of their will times by have

under steveloped relatively weak

highly valued appearance of

MPROPER shoes are another cause of unlauns of fallen arries. The foot gast not be thoked to death. A slice that facis to give room for the bals of the foot to expand, and for the toes to spread out at least to some extent, as the weight is brought forward in walking, is an inapproper shoe," A shoe that falls to distribute the weight properly in accordance with the requirements of the individual is an 'improper sline. Tight shoes, short vamps, and ogh breks, used to give the

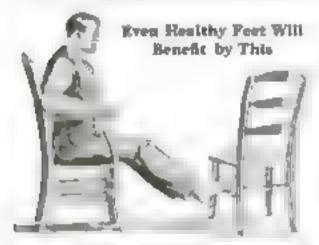


There are twenty six bosses in your foot connected by four times as many ligaments and optrated by many muscles and nerves. Above is the sagittal section of the foot. The lined portions indicate mancles, and the dutted line indicates the principal arch. Through misuse of your feet, the such may hegin to say and the bones slip out of place Just why the human race should become ashamed of its feet, except through neglect, it's hard to say. In China gentle women have bound their feet for centuries, to make them more ornamental and less useful. Never, since the days of sandals, has there been any widespread effort to strengthen and beautify the feet themselves. The tendency has been always to stress the looks of the visible shoe, and neglect the foot itself, coyly concealed within.

TAKE a good look at the position in which a woman's foot is held by high beels, throwing the toe downward—and the eye upward. It tends obviously to shorten the Achilles tendon, the tendon at the back of the foot, that is straight when the heel is flat on the floor. This is one of the gravest charges against high neels, Sooner or later tendon troubles are abnost sure to result. Incidentally, high heels do away entirely with the long, free, healthy stride of a heeless walk.

But proud shoes are by no means inputed to women. An examination of several thousand rookies at the Quantico, Virginia, Marine Station, for example, showed that four out of five were wearing shoes too short for them.

As a test some time ago, all the men in a hattahon of United States infantry were allowed to select sloves for themselves.



"Toeing the ber on the rung of a chair to develop the pedal attempth that walking should give but which newsdays two much riding the automobiles, street cars or buses is robbing us of

Then they were sent on a practice march. They mareled eight miles, camped twenty-four hours, and returned by the same route. On the first day thirty percent, and on the last day thirty-eight percent of the men were found to have severe foot troubles.

Later, shoes were selected by semy doctors for that same battalion. A march of 120 miles was made in nine days, and not a man laded to complete the terp because of foot trouble.

ANOTHER cause of labor arches is found in local injuries.

A young banker whose hobby was buskethall played forward on one of the teams in the local league of a New England city. One evening during the last minutes of an exciting game, the man who was guarding him alipped and fell. The banker, stumbling against his antagonist, sprained a toe. The toe didn't prove to be seriously injured, and a doctor, looking at it, said it would soon be all right. But during the following weeks, to keep the toe from highing, the banker threw his



What Does Your Footprint Show?

Left pedagraph foot imprint of a bornal foot showing good arch and the line. Center flat foot and eight the opposite extreme of about mally high arch sometimes caused believe feet

weight on the inner edge of his foot, and before he realized it he was started on the way to having a turned-out foot, which specialists recognise as a forerunner of most foot troubles. A long stege with weakened feet came as a result of spraining that toe.

General disease or prolonged physical weakness may mean fallen arches that give trouble years after the duense or weakness that caused them has passed away. After such an illness as typhoid while the whole body mutil in a weakened condition, it's easy to atrain the feet. Flat feet are likely to follow nervous prostration. Similarly, indigestion and fallen arches are closely alted.

AFTER my feet were down, I went A through the maseries of the damned. At times the pain shot clear up to my hips, like acute rheumatism. Let, the steps necessary to effect a cure were comparatively simple, if I had known them. And it was a surprisingly long time before I found anyone who det

"Fot in arch supports." recommended the first physician I went to, "That will end your troubles

But it dots I end them at all. I put in the supports and my feet hurt wome that ever. I know now the trouble was that they didn't fit properly. They were too high for my particular trouble. More I know now that, even if they had given me relief, they couldn't in themselves have effected a cure.

For a time I got rebel in an unusual way. I was supervising another motion

picture, in the White Mountains of New Hampshire. For days together we worked above tree luie, making our hendquarters at the hotel on top of Mount Washington. The uneven going on the peaks necessitated constant buluncing, shifting weight, pumping and all the rest that rough mountain going provides. A lot of our work was done among rocks where there was no trail at all. Though my feet protested strenuously the first few days, I was exercising muscles that needed stimulation, and they were in better condition after the two weeks in the fulls than they had been for months.

But my first lasting relief from the foot pains came when I got a particular make of remedial shoe, with a low arch support that exactly fitted my foot. The relief was almost instantaneous. I could hardly believe it possible.

To get a properly fitting shoe may sound easy but it s not. Shoes of the canal boat order aren't necessarily the right shoes. You don't cure feet just by toaking them look ugas. There should be a good bearing surface, distributing the weight every. There should be full room for the toes. Toes are nationally paryfax, and like to wiggle. It's good for you

In addition, there should be support for the arch—great or small according to the requirements of the individual, and support for the heel and correct position of the foot as a whole.

One of the most important points to fitting shoes correctly is that the "oreak of the shoe sole should correspond with the break of the "ball points." The front corners of the foot tripod, behind the ties, in the flexion of the foot when the weight is brought forward,

MOST shoe manufacturers realise, far more than their customers now important it is to fit shoes properly Proctually all stores find difficulty in second generally and no matter how good the shoe out the or how honorable the intention of the time facturer, placed on the wrong foot it will cause trouble,

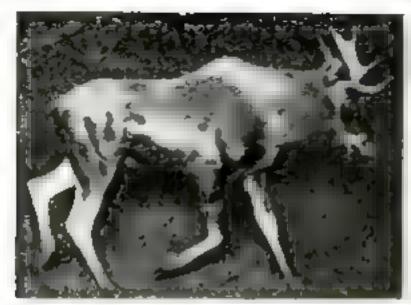
A wobuth entered one of the remedal sline salescopes in New York City. She had a long narrow foot. The salescape showed her a "common news" last, a little broader than her foot and with a low heel. She complained that it did not hold her foot fixually under the instep and that she preferred a higher heel. The salesman smiled wordy. He explained that the foot must have plenty of room and that high heels almost invariably make trouble.

The customer a little doubtfol, finally accepted his judgment and wasked hope-hilly from the store wearing the "continuous sense shoes. But nest ad of celef she got only more pain in generous doses. Com udong that the first correct had done its best and falled she tried and for make of "comfort shoe" and obtained relief. In her particular case a firm sough fitting instep was needed to support the rather weak arch in her long foot. Also, she happened to "formed an our !!)



To Strengthen Weak Feet-

Rise on your toes, barefoot, twenty times night and morning. Practice walking with a markle between your toes, When you sit, cross your feet for releasation



All photos courses & F. Dulton & Co.

A bull moose takes its own picture in New Brunswick, Canada—with the help of a trip-wire trap cunningly set



Recomme nibbling at built, actting off flesh behind camera. A second camera, operated by a second flesh simultaneously with the above, took this picture

A Camera Hunter Tells His Secrets

How You Can Trick a Squirrel into Taking Its Own Picture, or "Catch" a Woodpecker in Action

A NOTED armier photographer, wanting some good pictures of squarrels, and bickery mits on rocks in a wood near bis mine. A gray son red promptly finding them, for several days thereafter visited the rocks regularly twee a day. With that habit fixed, the photographer next attached a next to a trip wire, twisted tightly around a groove in the nut, the wire attached to the rangers so that when the squarel should a bide, it would take its own parture.

With its first quick unsuspecting nibble. the somerel set off the flash, and a fine picture was the result. But thereafter the photographer got no more pictures by this method. The squirret snew what was corning and beneficious, quick moves ment, when the explosion occurred prodirection's a our on the parte. Moreover, after twenty more attempts, it learned how to get the but without car stag an expressor. Each true it would finally approach the and topelest with its nose, jump back as if the nut were red-hot, and then proceed expertly to free the nat without the slightest pull on the wire. Regularly, each day for a week, the samrel came off the victor, a theost welling a single flash.

The photographer finally had to get his pretures by building a blind, concealing himself in it, and operating the flash by pressing a push button.

PASCINATING and surprising are the tales told of the always exerting, sometimes dar gerous, work of the photographer whose thrill it is to trick the wild langs a tolay and their picturestaken. The ideal tants of forest and field, water and air are less with up to face the camera than humans, and those who make outdoor photography their profession or bobby have to be more willy than their quarry. Some of the secrets of these hunters, who find the camera more exciting than the gain, have recently been told by Waliam Nesbit, the photographer who

figured in the squired modent above, in his fascinating new book. Here to Hunt with the Camera.

Many of the best annual pictures are taken with flashlight snares. Flash lamps are connected to wires stretched across a trail or builted so that when the annual takes the built he fires the flash powder and takes has own picture. A second camera and second flash are sometimes so placed that they will photograph upon one plate not only the flash from the first lamp, but the annual sciting it off.

Anyone can set this sort of trap and

probably "exteh" something right near his own home, says Mr Neso t, for more small annuase rough about at might than most of its know, Skurks, raccount, oposiums, rabbits, are the commonast prowlers.

Most of these grounds full for a choese sandwich bant. Mr. Nesbit cuts small pieces from the sides of the cheese so that the chrescrioth will be on the two outer sides when folded together. Then were is wrapped around the sandwich, which is long from an upright to protect it from more. Sometimes are fixed into the "studio" by a bast line, leading in that direction. A trail of salt or vegetables is especially enticing.

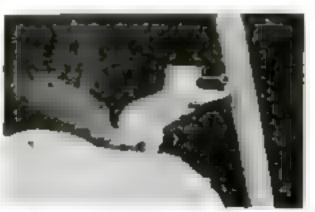
FOR an artistic background for the annual to pose against as he publicator choice sandwid branches ferre, even rocks, are arranged. Then the camera is fixed, pointed toward the place the annual is expected to occupy twelve feet away for a small animal, twenty for a large.

Animals, like celebrates, get used to the spotlight and come back for more One skunk returned to the same trap five nights running, not minding the flash and bung so long as he got his sundwich. Mr. Nesbit had to break a cat of the same habit by a load of salt fired into its whiskers when the flash went off

A sport of kings, affording tremendous thrills, is taking flashlight pictures of wild animals, especially deer and moose, from the bow of a boat at night. This is generally known as "flashlight packing." and is done mostly in June, July and August on lakes and streams having bly jude and grasses that pame come to rat.

The hunters go forth in a boat too steady to upset when the flash goes off. The darker the night the better, as the animals cannot see the boat behind the "jack." This is any lanters that throws a single beam of light forward, none striking the boat. An electric jack with rheostat handle is if outcomed on page 147)





The gray equired surprised into taking its picture. Then it outwitted the photographer



Thrilling Escapes of Pony Express Riders of the Air

7 TTH the morning papers of September (westy-fourth screams) mg out that Gene Tunney was the new heavy weight champion of the world. and with reignde photographs of the championship figl t miracosous y appear ing to Western dashes on the worst morning-after in Dempset a coreer there was propably not one among the host of readers who gave a passing thought to the men who had risked their lives to make the appearance of those pictures possible. Yet, so hazardous was the undertaking that of all the aviators who were whedtiled to fly over the Adeghenies and westward, bearing photographs of the boat, only two were able to penetrate the fog orak over the mountains and make their deliveries. They were Captain II A Chandler and Wesley L. Sunta, air mail ridola.

Alone, his only advice instruments on his board, his only advice his own resourcefulness, each plot butted separately with his unyielding adversaries, the elements. Fug and rain and darkness two hours of it without night of earth, without a beacon or a fundmark to guide them—flying blind through a fog that obscured their surroundings as completely as if a canvas had been drawn over the cockpits. Whirring dizzily through space, three thousand feet in the air, with your eyes closed?

And yet such a battle is daily life for the sir mail pilots.

The mail must be delivered. Schedules

By IL C. NORTH

must be kept. The mail trains must be betten. The very existence of the air must depends on speed. Even the comments must be conquered. I rele Sam would commensure no fair weather their.

It is between Hadley Field New Brunswick New Jersey, whence the New York air mad is shipped, and Cleveland Ohio tout the battle has raged the bottest And that hazardous route, beset by fogs, has been the field of the greatest victory



Planes Have Headlights, Too

For night flying the mail planes are fitted with 150 000 candle-power headinghts to insure safe land ug. Here a mechanic is adjusting a headlight on one of the energiperor to leaving the field

Forced to fly on schedule time, regard ess of adverse weather conditions the Hadley Field priors have all limit perfected the science of flying hand attack some gat rig a parte by the use of notemants when not a sugar grade is visible cortice. the so p. After months of practice and experiment, they are now able to By for index, with notling but the instruments to direct their Hight without straying sentences from the course. In currying the mail the high of the Dempsey Tobacbout Capus a Chandler few hand through the fog for an more and fifts mirutes. He bit a "low certain" force innuites out of New Brunswick, and the first earthly indication he had of his whereabouts was when he came out of the fog and mw the lights of Hoomsburg, Pa. For nearly two hours he had kept to his sky route, solely by expert use of hic nay gational instruments.

The near perfection of blend fly rg has been attended by the Hadbey F etd prices only through trul and failure. It has simply been a case of master the fog or give up the route. They have learned, through stremuous experience, to fly without visibility, because they had to

Eight pilots fly from Hadley Field to Cleveland, and their adventures, the mention of which they dismiss with a shrug, are more thrilling than ever were the Pony Express and the Western madceach. In summer they must tilt with fog and thunderstorms; in the fall with still denser fog and more severe ramstories; in winter with bliznards and the accumulation of ice on the propeller, struts, fabric and wires of the airplane; and again in the spring with fog and anowstories. Always there is engine trouble to contend with. Every season hears fresh enemies, and every day challenges the pilot to a new compat. And yet the mail is delivered and the schedules are kept.

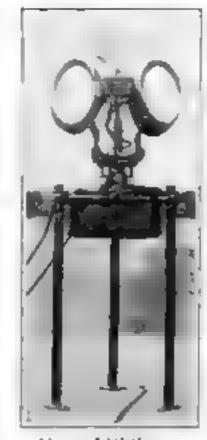
The night of the inauguration of the air mail service between New York and Cleveland is the one that Dean South remembers most clearly Large crowds had gathered to see the mail leaded, and to watch it take flight on the wangs of the huge plane.

SMITH hopped into his waiting plane and was soon rapidly disappearing westward. Watching Mountains Cush-attick Mountain Musconeteong Mountain the Delaware and lights that indicated haston, in Pennsylvania now, and going in what seemed record time: Morgan Hilf—Leligh river—Kittatiny Ridge

- Tamaqua; the mater burnined steadily on. Manch Churk Mountains—Broad Mountains—Catawisa Mountains—Broad Mountains—Catawisa Mountain—hights a Isonhory—Sussipenanna river—Workle-bleck Mountain—Ninany Mountain bradlights of an auto gleaned on the road below—now a few senttered lights of Beliefonte, for it was getting toward morning. Next would come a beacon. Then another beacon, and then a weather reporting station.

WHAT actually came histead, was a fault chug from the motor and solence save for the rish of air part the plane. The engine had gone dead!

Smith was about five bondred feet up. He used about two hundred of the distance trying to get the motor running, but it was useless. He dropped a fare and searched the surrounding country. He saw only woods and buls. Then he spired a small, smooth field. But at the end of it were a house and harm. Rather cramped of arters for a landing, but the only possible one.



Airway Lighthouse

A period of honeum like this marks the route of might. Four searchinghts mounted on a turntable tower fifty feet high sevolve as tomes a minute.



The Airman's Weather Vane

This edd "wind code" stop the landing field hanger tells the galors the direction of the wind. It is illuminated from above. Notice also the five million candispower revolving beacon which lights the fives into part.

As he headed downward at sixty miles on hour he knew he would crash the house, unless he "cracked up." The plane plunged madly. Ahead was the house. Slightly to the right were the barns. A few seconds more and he would be upon them.

With the slop under perfect control Smith swong sharply to the left as he neared the ground. The left wing booked into the earth and crombled under The plane privated about it in a hoge semicircle, stood on its nose, and crashed on its back but a few yards from the house.

Smith claubed calmly and indort from the cockpit, and viewed the rums of his plane. Then be approached the farmhouse and knocked. There was no reply. The farmer had slept peacefully through the whole performance. Another knock and a kick brought as ungracious reply from within. And Smith returned to his plane to start unloading his cargo.

In a few minutes the farmer sleepy and ill natured, came out and phiegmatically viewed the wrecked plane lying on its back.

"Do you always land like that" he asked drive

Smith gut the mail from the step alone and communicated with an emergency field. A new plane was sent him, and he continued his flight. As he neared Cleveland, he ran out of gas and had to make another forced landing, this time without mishap. The mail was taken by truck to Cleveland, whence it continued its journey westward.

SMITH apparently does not consider this experience especially exerting. Hooking one wing into the ground at sixty index an hour, and ending up himositi the wrickage of an overtimed plane, he assemes to be a reasonably safe way of landing. It is that favorite method of avoiding a head-on coll sion

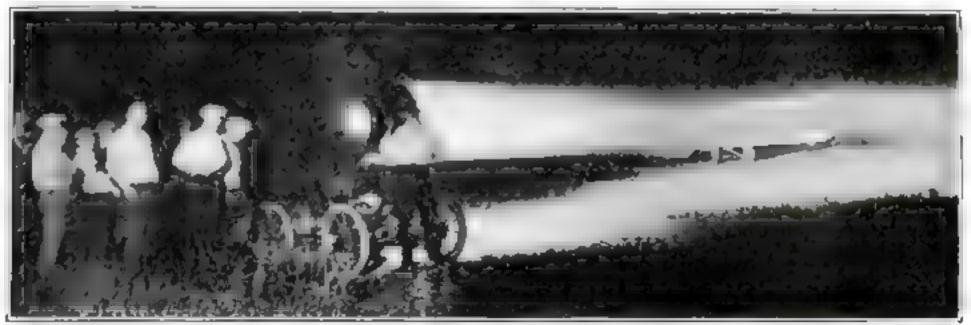
"We are always getting into tight places and getting out of them, and that's all there is to it," he told hie.

All of the pilots assume more or less the same attribute

toward their experience. Constantly facing danger ascinent and death, they consider it all a part of the day a work, what they are paid for

"We have thrills, evertenent, close calls of course' said one of the Had ey bield pelots, Capraon H. A. Clander. "But they are only incidental. That we reach Greenand on time is the map stant thing." He called attention to the progress made in flying during the next year by citing two "nacidents."

Last year he recalled. "I started from New York with the mail for Cleveland. When about theirvilve minutes out. I lut a fog bank. At that time we had not developed the use of our instruments nearly to the point we have today. For an hour and ten minutes I flew without the faintest conception of where I was headed, keeping to what I hoped was my course by sheer gresswork. Finally I came out of the cirtain and aighted the lights of an making a city. It is got have been any city within an hour a run from Hadicy. First.



A huge portable searchlight marks out a path as bright us day to secure a safe landing. The light is anounted on a rubber-tired carriage

Harnessing Thirty Million Horses

Marvelous New Ways in Which
Superpower May Ease Our

Labors and Cut Costs

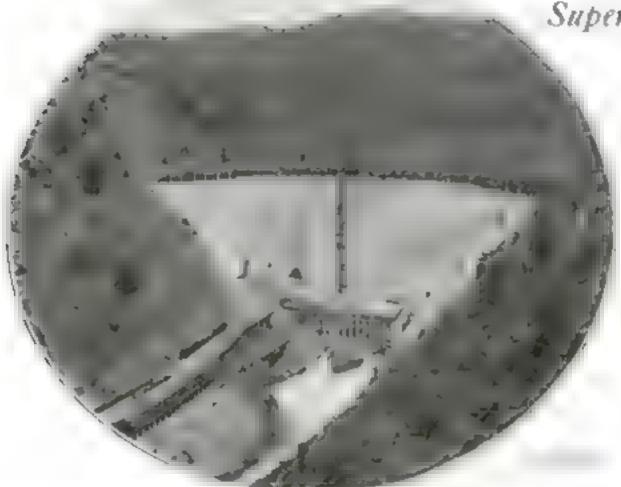
By MANUS MCFADDEN

the radium atom. As everyone knows, radium atoms are given to exploding. When they explode they give out power. A small fragment of radium will keep itself warm continually by the heat that its atoms generate within its mass. The amount of heat produced is many thou sands of times as great as can be obtained from the same weight of coal.

M NY secentists believe that surface vast amounts of power may be stored up in other kinds of atoms and might be got out, somehow, for the use of man. This project has been discussed actively at every power conference to recent years, and Professor Norris now offers hopes of its storess. But there is scaret possibility this will come as one get cration.

In the meantime engineers are making rapid progress or athrong the power we have at hand through the development of superpower systems. The newsy comed term' superpower? has been loosely used, even so engineering circles. Shorn of all its mystery, however, it means simply the coordinated production of electric power. This is being brought about by interconnecting undividual power plants, both steam and by dec.

This progress is largely due to the perfection of aigher voltage transmission and to mechanical improvements in generaling power. Interconnection, high-voltage lines and large units of production are vehicles and devices that make economical production possible. They are the physical structures that form a great power



A Future Link in a Great Power System

This is a typical power and impartion dain one of the many which are being constructed throughout the manney and will eventually serve as that in the augmenture invited. The huge structure of majority shows here the Euchequer Dum near Lie Angeles. Calif has ke up the maters of the Mee of river to cover more than a thousand occur. The dam is till not high and measures 955 feet along its conving creat. The mighty turbines in the power house at its base develop a capacity of 36 500 hierepower.

A GENERATION upon the word power held little significance for the average man, Steam and the track, to be some were commonplace but they did not affect every individual personally.

Today however about every person in the out in a na engineer in some degree and usen power at every line. If he doesn't drive an automobile he has a radio, a vactom element in power for any electrical flation or any one of a dozen other peressitiosethal depend on power for their usefumess. So great in the influence of power or our present life that, were it out if an easily we would be helpless in fact a valuation would redlapse. Just as the poweing out of a little electric light first throwing out of a little electric light.

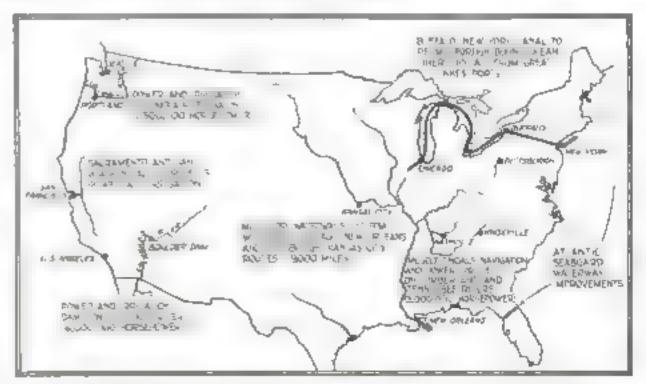
So the will measures that we read statements of current engineers that two of our principal sources of power resulted and will be exhausted before many more generations are possed.

And I am we near promises of a new eneap and mexicus stone power just around the corner. That power is to come from the atom. Not today nor tomorrow, per haps, but it is to come surely. We have the word of science for that

In his annual address as president of the American Chemican Society in Philadelphia recently Professor James F Norris of the Massachusetts Institute of Technology producted a remaking of the entire social order through the insistery of the atom by science

"We know the atoms consist of unthorkable amounts of bound up energy he and. "They are like a jack-in-the-box, When we learn how to touch the button the energy will spring out and we can use d."

And seience will learn how to touch the botton. In fact it has already homesed



This map shows the projected or intended power and waterways projects in the United States, Engineers hope eventually to link the entire nation in a network of economics, power appply

With improved transpresson we can now undertake the development of
the cheaper sources of
power from distant waters,
such as the St. Lawrence
river and other streams removed from the great
centers of population. Also we can look to larger
steam plants attrated in
the coal fields, thus doing
away with the expensive
aucting of fitel for wide a
scattered power producing

WHILE the saving on freight would be considerable. There are eronom es would tend to cut deeply into the cost of power were interconnection gencral. For instance, isolated manufacturing plants at present are operating on an average of twenty percent of their capacity They must have large capacity to furnish the reeded power during "peak" hours and cousemently they are working prost of the time on sourt With a tereor aretion it has been stelesproced. They would be working stall trace at fell capacity. Morey myested ra equipment would earn five times as naid as at does now. In a bitton, there in the possibility of using our water powers to gesitee advantage. The flow of water is sensimable. and the power produced varies greatly. In flood Luies excess power from

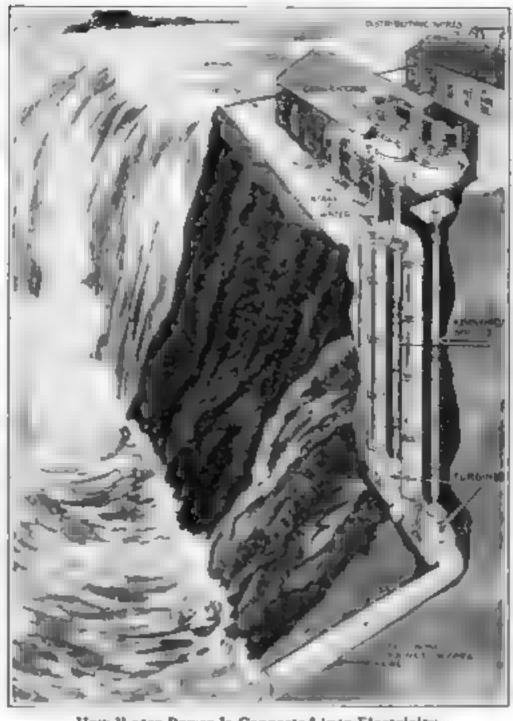
the living plants could be turned into contral reservoirs and steam plants could be shot deem into needer again to low water periods. The saving in coal alone would

be tremendo ec

Another effect of superpower would be to distribute the power load evenly at all boars. For ustaine. New Engand and New York power plants count send most of the day I no to the industrial centers and most of the night the into metropoutan centers such as New York City, Boston, and other large users of right current. The result would be that, with all plants working full capacity at all hours, power would be plentful and consequently cheaper.

AT PRESENT there are approximately 6,000 separate power and lighting systems in the Linded States. To make for the greatest economy, we need interconnection of these isolated systems over large geographical areas, so as to provide great reservoirs into which larger streams of power may be poured from steam plants and our larger water powers.

The connection of all the plants in the country in one giant system is not possible at present one to the limitation of our present day methods of transmitting power. Power can be carried by wires up



How Weter Power Is Converted into Electricity

Weter at the bred of the falls, surging into the spallway of the power plant, treates thereigh at solute and plunges down great paper or petistocks, to drive a series of turbates. These through tall shafts are connected with the late generatives at the surface whose power is sent on its way through distributing wires. The great Nasgara Falls power plants are of this type

to 800 moles without wasteful leakage but tout is the Limit so far. It can easily be seen then that even the great energy of Niagara Fads most be at lived at present without a comparatively restricted territory. Science, however is lengthering our transmission lines day by day and engineers are confident they will base channels for distributing their power as fast as they are able to develop and connect producing outs.

THE benefits of superpower already are being illustrated in the systems of large operating companies in several parts of the country. An excellent example is the "superutdities" of Caldornia. One Cabfornia company represents the merger of about 125 up is which once operated independently. This system has an animal institut of about two bidion knowall hours, two thirds of which is produced by water power at a great saving of coal.

Smales conditions are found in all of the Rocky Mountain and Pacific coast states, where gigantic superpower systems are being developed.

In the Southenstern states, too, a vast network of superpower transmission lines is spreading out. It reaches from Alabama to North Carolina. New England, also, is making progress in this direction.

So far the most important superpower systems have been only up in areas where water power is abundant, but there are equal possibilities for comonly in territories where steam possis are necessary.

Whether our new power consestrom stemmer hydroplants, or even from alons, does not enseen most of us so much as the question of how we can get cheep power and bits of it

TODAY power is produced at tremendous expense and labor. Your pay your share of this expense every time you make a pure asse. Your clothes, your food, your antimoiale, even your annies ments depend on power for their production. The cost of one ing cost and pumping oil are melided in some degree, in everything you tary.

With thems power as at able to everyone, and a practical means of transaction of an anting stat low cost perfect d. The production of all the countries are exceeded by productionally and their cost, record correspondingly.

Take for instance the item of leather in shoes. This as yet know, it made from the index of horses and cown. The antionism reproductive manufactures and of their numbers epond of their numbers even their school of their numbers even

on the Westero states where the argest herds rount. But in the desert waster of this country there is enough rount to ruse a bundred times as many cattle as we are now producing. It as the done now because hiere is the grass of these deserts.

Could be pumped to the deserted of they could be turned into garden spots. Already this has been done in the Imperial Valley of California, where the waters of the Colorado river have made a desert the most productive garden in the world. In the Imperial Valley it was a simple matter to tap the Colorado and distribute its hie giving water over the and soil.

It is not so semple a matter to water all our other waste places. It is feasible from an engageering point of view, but the expense of pumping water to high elevations and for long distances makes it commercially impractical. In other words, it would cost more at present to irrigate the scal than the land and its products would bring in the market.

Flammating the ligh rost of power, lawever, every square foot of dry land in the country could be traggeted at a tremendous profit. (footeneed on page 150)

Folding Plane for Submarines

The World's First Under-Sea Flying Machine Designed for U.S. Navy Patrol



Above Tierream In her opnsach hier er andere men bei der bei d

specification and a

By the state after its sight at the section of the

Till the land long sconting as planes from the decks of warship as not new all the great navies have adopted the practice with varying degrees of success. Thus, however, in the first time it has ever been applied successfully to under water craft. Navy officials declare that it will give the submarine an effective patrol range for greater than ever was possible before

The proad pilot of this wenderful little water bird is the first sid marine airpsane pust in the world, Lieut Adolp i C. Allen.

HEN Usele Sam a submission School Concept of Long Island Sound near New London, Conn., a few weeks ago, it was seen to carry a strange burden on its back. The burden was in the form of a long cylindrical tark resting on the submission is deck just aft of the conning lower.

The rear end of the exhanter opened and from it like a moth hatching from a coroon, there appeared the body of a

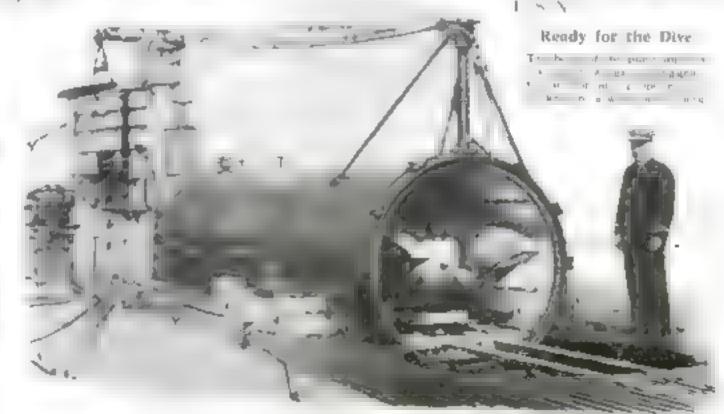
baby flying machine a sentable. At first it was wingless and turless. There was no propeher at its nose and no landing gear beneath. But quickly Lies, for came out of the roroom and quickly they were fustened to the body. Now a surely little single-senter rested tently on its pontoens on the deck of the submarine, ready for flight.

THE schmarine schmergest nutil its deek sank beneath the water a scrince casting the scaphane indoor. With a vivil resepower material parties away and propeller away skinning the tops. The waves, dealchyding rate the sky

So, successfully, was completed the first test of the Insted States Navy's newest idea in fighting equipment, the submarine seaplane, designed to said aerial "eyes" to the ships that scout beneath the sea.

This remarkable midget plane that can travel under water was designed under the supervision of the Bureau of Aeronautics. Weighing only 1,000 pounds, it can be taken out of its shell and

assembled to noice



The New Wonders of the SEA

Strange Fishes Climb Trees; Carry Searchlights and Saws

By ROBERT E. MARTIN



This Grouper, or Jewhelt, umphing 200 pounds, is not of the biggest and aghest of all finned treatures. Its mouth is his mough for im aquarium

TREATEST wonderland of all in the sea. That sounds paradoxical, but in the dark, unexplored depths are more marvels yet nuknown than are on land. When every other field of nature is explored, there will still be new things on the bottom of the sea.

The biggest deep-sea fisher, for a stance, may be still unknown to science. They may be monsters. Thus for only small deedges have been used. No man can tell what strange creatures unproved dreaging methods will bring forth.

What is known now of the sea a marvely only whats currently There are fishes with swords and saws, lishes with knives, with wangs and with lights. There are great sharks and whales, as well as tray animals of whom it takes forty million to fill a small net. Every scientist who goes hunting in the deep sea, if only 200 index from the coast of the United States, brings back some new creature. The ocean teems with life.

The field in vast, for the ocean covers three fearths the sariace of the globe and is hundreds of and ions of years old. It covers an area of 130 000,000 square miles. Even its water is wonderful, for wint we call the "salt seas, hold gold, copper and from sodamic chlorate and other manerals. Their fides, strangely controlled by moon and sun, are a source of power yet anuthized.

What are the greatest wonders of the sen' Ask Dr. Charles H. Townsend.



Of Ancient Ancestry

These musifish burrow in mod along the above. They are descended from one of the earliest forms of each life, which counted ages ago

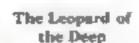
Lighted Windows

With rows of lighted "portholes" Iming ets wrighty sides, the Stylophthalmus winds like a lighted rightey train through the inky blackness two miles and more beneath the occas's surface. Its eyes are at the ends of two long stalks sticking from its head like two lamps

Director of the Aquanum in New York City and you will hear some strange and interesting things.

What makes the public wonder most and what is most wonderful are not always the same—he will telt you. "People who come to the Aquazium are most interested in the little sea horse that clumbs trees. He is among the few fishes with grasping task. Like a mankey, he uses the task to cling to seaweed and other marine objects. We have a little tree in

hes tank for him to clamb on, and he likes it. This hip pocampus' is only



The sel-like body of the spotted morey is prepared with innomerable dark spots on a whitish background. Its habitat is in the tropical Atlantic Ocean



Glows in the Dark

The Opinithoproctus is one of the odder of luminous futies. Notice how the light shines between the heavy senior of the senior of the senior.

ax metes long and a shaped like a question mark with a horselise head. When he dies we varied him mound him on a glass paper weight and hell him at profit enough to keep the tank full of live aperosens.

O had big things. After the senlarse, they like to look at the 200pound Grouper, one of the biggest of fishes, called Jewfish at the books. They like to watch the shark swimining about with some 'shark such ers fastened to his under side. These suckers attach themselves by air suction disks, like vacciarclemers, on their leads. They are block fishes, shaped somewhat like the shark, though of coarse nouch smaller, and are 'commensals, meaning that they out with the

altark. They take the semps that fall from his takle. The section disks are among nature a most remarkable apparances.

"Probably though, the greatest allaround wonder of the sea is the common cel. We have found out recently what a marvelous creature it is. Here is a fish that looks also a make, attends an annual beague of Nation's meeting in a certain spot in the Atlantic, can camb the Alps. does not have children until it gets out

The life history of the cel, which has mystified men of science since Aristotle has been solved only recently. The cel starts out as Leptocephalus, a larval form with gleaning eyes, thin as blotting paper and so transparent that you can read a newspaper through it. It is hatched from eggs last in the Atlantic south of Bermuda. How the eggs get there is one of nature's strangest, newest stories.

"The newly born Leptocepholt separate and form two great streams or currents, each swimming slowly to the home of its



parents. The American Leptocepholus turns westward, and after a year, reaches the American coast. The European species turns eastward and takes two years to reach the streams whence the parents descended to the sea. Swimming upstream, against the current, they go as far inland as the burners of Switzerland.

"The female cels go to the headwaters, males not above tidal waters. After the females have passed years mand, they

decide the time has come to have a family. So, moved by this in stinct which may be coupled with a premonition of coming ileath, they start for the annual cels' League of Nations meeting in the Sargasso Sea. In its warm waters, mane and female cels from America and Europe meet Taere is nothing quite like it in nature. When the two great streams of Leptocephali start for America and Europe na messengers from this meeting, the parents, having fulfilled their desfray, dæ,''

Bill to return to what the public bless—big things Dr. Townsend thinks the public may not be so far off, after all because three big creatures are certainly among the most won derful things in the sen. I say are our childhood friends the while, the shark, and the sword fish.

Consider the whale. Little a ore than seventy-five years ago be lighted the world, and built up a good slice of New England. At one time there were no fewer than 700 s. ps.

the American who may Reet. Until more recently, the whole supplied the whilehone for Women's corsels. and for the whips when they went haggy ndrig. He supplied food and fertilizer. In it strange that he is very scarce today, and that some kinds of whales are ut danger of extertringtion? He is the surgest animal of land or seg, agraed times severty feet long, vastly

negvier than the heaviest of elephants.

THE hammerhead shork has one of the most extraordinary formations among toshes. It has a flat head, with arms or vings—too broad to be called horns—exterding outward, with its eyes at the ends, it grows about fifteen feet long in tropical waters, and haby hammerheads a foot long have been caught off Sandy Hook. Or Townsend does not agree with Witham Beebe, the famous marine explorer, that snarks are harmless, and says he has many records of the killing of human beings, mostly in tropical seas.

The swordfish really uses his sword a pointed nose more than a yard long mainly as a club to stun fishes. He darts among a school of small fry, and literally clubs them into submission. Familiar potions to the contrary, he does not rain

his sword into whales, though he has been known, in desperation, to thrust through the bottom of a fisherman's boot. He weighs 700 pounds.

Now, those are three wonderful creatures of the sea, 'said Dr. Townsend." But the wonders to scientific men who visit our Aquarium are somewhat different. The two creatures that arouse their greatest cursosity are the horse-shoe crab, or Limites, and the mudfish or bowfin,

A Curious Parasite

H was Y this is a years

The state of the state of

An Under-Sea Toy Balloon

One of the oddess of all fishes is the puffer, which, when taken from the unter blown tacif up like a believe a h are of each lows. The believe collapses startingly

Sea Horses That Climb Trees

The automobiling timbe sea horses are the only fishes that himb trees. They have grouping toils, I be monkeys with which they ding to praweed. They are shaped like question marks, with hierathis countries.

known as long. The Aquarium donates many of these to European accentists. The horseshoe crab, which looks like a flattened bechive with a rat tail, in the only living animal related to the extract trilobite, whose fossils are so well known. The modfish, which looks like many other fishes to laymen except for a thick-ening of the tail, is a descendant of one of the early forms of fish life. It belongs to a line long extract, duting back unknown thousands of years. So you are the crab and the modfish are, like some people, interesting chiefly because of their ancestry.

'If you want to get a real thrill, go down deep into 'the waters under the earth' and see the strange creatures there. In that eternal darkness, miles down, under terrific pressure and intense cold, nature has evolved creatures that can live and flourish. If scientists tey to bring them up, they die before they even reach light and air, so that what we have to prove they exist are ab obolic specimens in touseums, models, pasitings and photographs.

There is the 'Bland Ipnopa', for instance. It has no even but carries a searchlight or top of its head. Now, what does a bland fish want with a searchlight' Nobody knows, but perhaps the light

attracts smaller fish when the lipnor is hungry. It is brown in and of rather small size.

best dulging in post Volstend is a get of dream about a Stylotot, and then owens off the Notophthalmus in a silver cond. wriggly, cel-like fish with two organized steeks steeking out from a density eyes at the ends of the stacks. Also, he has a string of lights along either aide that wases burn look like a subway to a

I FYOU goswimming and get intection deep water, the Controwill get you if you don't war and. His mouth is bigger

there his body and in fact mouth stomach and notestines seem to be all one. He may not see you, though, for his eyes are no higger than protected and are located on the tip of his

REPORT JOW

Мвиу деер-вея f sb are lumines cert "it iaji ito ane way or another, to ilto accorde the surround n g goods There is the hantern fish, about the size of a minnow, two icel es long, undescent copper above and ailvery white below, yet with rearly a handred hights. These are made by small round lums mous organs divided a some species into three general sets, thirty-two purport side of the body, I we less a transper larreger ners along hear and body and from four to

eight above or he on the base of the fail. The lastern fish can turn them on or off as he wishes. They have small fishes, and help him escape his enemy, the dates weather "cater of stars." whose favorite meal is a well lighted hastern fish.

THE Beebe expectation on the Arcturus got from the depths some new varieties of lantern-bearing Sea Devila, hideous-looking black fishes with lights at the end of statks or tentacles growing from the r heads. These creatures are little more than cating machines, with enormous teeth outlined with 1 immescence. In some species, the month is four fifths of the body. Female deep-sea fishes have been found with tiny adult male fishes growing from the side or head or behind the gills. These parasitic males get all their nourish— (Continued on page 1)1.

Amazing Ways We Use WASTE

New Discoveries Feed Us, Clothe, House and Transport Us with Materials Once Considered Junk

By LEE CARTER

WHEN Heary Ford purchased 199
steel purchast staps from the
limited States to vernment be
wasn't not nated by altrustic motives. It
was merely a question of money value
has one of these apparently measure ships
represented just so many tors of perfectly.

good raw material that could be used in the manufacture of curs.

Thriv five of these shaps a real v have been torn down and made over rate actomost less tractures, much uses and implements. The steel and niches went into acto engines and chooses the humber in booms and spars was turned acto wheels and auto bodiest scrap wood and cock were ground for packing purposes, scarchaghts were sent to light Ford, avention, fietes, dook

tember was made ato crates and bottes, even made were melted down and the netal used again. Every temp of the veocle toru down so far last found some

use in the Ford organization.

AND Henry Forces subsuging of the materms in these otherwise ascless shaps is but one phase of the enormous effort that is now being made as every line of monstry to eke-out our rapidly awarding

ampply of virgo materials

The World War, of necessity did much to bring this new senace of salvaging waste into practice. Some then there have some one after another remarkable discoveries of new ways to feed us, clothe us, house us, transport us and keep us confortable with materials that once were considered junk, Weeds, comistales, old shoes, raga, the scraps from our tables, rusted and broken-down machines, the garbage and sewage of cities, broken lioues and harrels—these and many other

Below, piles of discorded magazines which will be emissered into new paper and eventually become new magazines again, at a large plant missied man Antioch, California

Tall to personal and Antioch, California personal law and the series are series and the series and the series are series and t

(Above A new magnetic machine for separating high timus monel turnings from the lower value turnings of tron and steel at the General Electric Company, The process seven \$10,000 annually is excep-

Hems of "Trash. sesence has found, can be salvaged, saving millions of dollars a year.

Net even with this new knowledge the amount of waste in the modern world is appalling. An outstanding example is in first, particularly automobile foel. Twenty-odd nullion cars in America are bornoug up fuel with profligate disregard of the future.

Not in that all. In burning this feel, even in the most efficient mater cars, there is a tremendous waste of energy. At least one third of the theoretical power of the feel is wasted in the exhaust another third in the radiator, still more in frie tion, so that in the end only a small fraction is put to work in propelling the ear. Engineers are seeking to develop machinery that will anlying this energy. Meanwhile, by improved processes of petroleum refining, they are extracting useful by-products ordinarily wasted in gasoline combination. For example a cer-

tion go may readine which clogs good or motors can be reest

ered and used for making artificial cubber. The possibilities for such salvage work have larrely been touched.

In coal consumption the waste has been equally extravagant. Of every ton of enal you born or your former, at least three fourths is lost up the channer. Her here the work of sacrage has progressed further

GASES given off by burning coal are being used to accrease the growth of plants. From coal for bug-fresh of valuable products are certificated, while the waste products are certificated coke overs are responsible for the prosperous American dve craisstry. And only the other day chemists amounted the success of a new fuel from coal which will be smokeless and almost without waste. It is called "semi-coke, besides being smokeless, these attorners as easily as coal and intelligent more casis; thus come, in the production by a low-temperature process, gasen, ods and aminous ordinarily lost when coal. I intersection page 1-41.

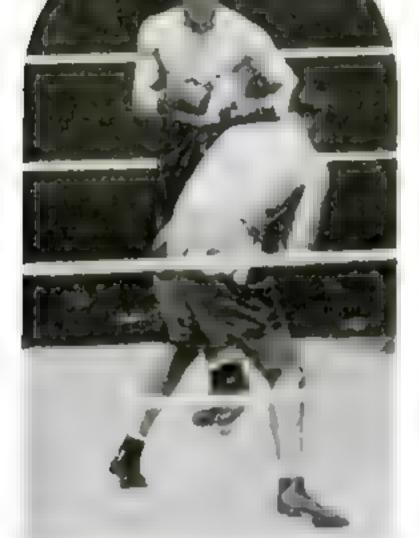


Reconditioning old ropes at a plant on Staten Island, N. Y. The material will then be shipped abroad to be made into choop experts,

twine, and similar products. This is one phase of the effort being made in industry to seve weste in our dwindling supply of raw materials.

Tunney Tells How

"I Practiced One Punch for More Than a Year," Says New Heavyweight Champion—Why He Knew He Could Not Fail



The Battle for the Championship

Despecy. It the foreground is warring in with his characteristic crouch, while Tunney waits his opportunity. Note the look of determination on Tunney's face.

browed, necessing, affaine with his nessets delight in battle, lenged from a success in the Sespondentering last fall, it was with the confident benefit at he was about to begin another of those short, vicious slaughters that had marked his seven-year reign as world's heavyweight champion

A few seconds later, Dempsey, the "kilfer," the "unbeatable," had lost his championship. True, it required ten rounds of figlifing—a half hour—before the title officially changed hands. But actually the championship had passed within a half minute after the fight began. It passed with the delivery of the most amazing blow ever known in the prize ring by the most remarkable young man who ever stepped into the "squared circle."

The blow was a straight right-hand punch that was aimed at Dempsey's jaw, but which actually landed high on his left cheek. I call it the most amazing how for several reasons. First, it won the heavyweight championship for a man to whom not one person in a hundred conceded a chance. Then, it won the fitte without a knockout. But the most astonishing thing about it was this: Although its artiful delivery required only an infinitesimal part of a second, it really started for the rugged and despernite face of Jack Dempsey about fourteen months before.

For that I have the word of the man

who conceived and executed the punch—Gene Trancy, the new heavyweight champion.

Finney told me the amazing story of that blow on our way from New York to Philadelphia a week or so after the fight. I had informed him that the editor of Poet Lox Science Monthly had asked me to obtoon from him los own version of the battle with Dempary.

"OF COURSE, gladly "I ve lood a warm spot in my heart for Port 2.48 Science Monney by for a long time. In June. 1925, Portural Science printed an article I wrote. I had called a "What I Have Learned about the Vulnerability of the Human Body," but the editor changed the 1 the Made Me a Champant."

вая Апетиал

heavy weight champion at the you remember; but in the light of what has happened since, changing the title of my article was almost prophetic, does to you think? And Jack Dempsey's body be added with a sly grou, "was just as vulnerable as that of anybody who happened to read my article.

"Anyway, I can add another blow now to the ast I described in that article. Let's go lack to the beginning.

"For seven years, ever since the day Jack Dempsey knocked out Jew Willard at Toledo, I'd had the iden that some day I was going to be heavyweight champion of the world. Maybe the idea wasn't reasonable at first, for then I was only a light heavyweight, a 'long strung bean' of a youngster, just turned Iwenty one. I had won the boxing championship of the A. E. F. in France, and I knew I was bound to grow heavier, stronger and more skilful with training and practice. Still, before the Toledo fight. I couldn't quite visualize myself as an equal match for a grant like Willard, who stood six feet, six, and weighed two handrest and fifty pounds or so

"Then Dempsey beat Willard, Dempsey was hearer my own mise. "I would have a chance with that fellow," I told myself. Some of my old buddles in the Marine Corps, who discen me fight in France, thought so lost so I planted out after the champions of presented.

"I ve always are to think things out for myself—to plan a send. In dending to go after the I cave we ght championship. I knew that lat or mass methods wouldn't get me far. So I concentrated on the problem and tried to last all its details in order.

"I decided that my task of winning the latte consisted of three things: Perfecting my physical resources for that particular job: studying the man I was to meet, to learn the vulnerable spot in his armor, and acquiring a mental mastery over myself so that I could go through with

the job oney stedly wothout in stakes and false motions.

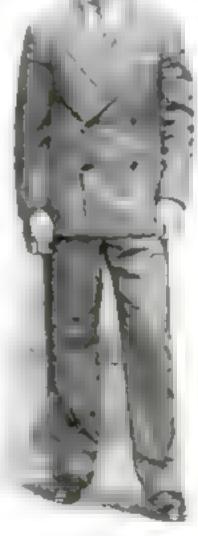
"Kind of a large order, was not at!" inquired tone, "And don't think I think I to begin

with 1 needed about two ity more pounds of figiting weight before I would be ready for Dentises.

"DID you use any special methods for building up your body?"

I becomed, "Nothing muchaside from same mitdoor. exercise and plenty of sleep," replied the chanihabits, no learings toward dissipation, so it was in I difficult for me to live a regular, ordered ble. But I cut out tex and reffee and drank milk -- v also I made it. a point to keep away from the city as much as possible. Although 1 was born and raised in the Greenwich Village section of New York City and love my old neighborhood, I ann happiest and feel best when I'm off in the country, clumbing the bills, chopping wood, h keig and playing golf

"When I first fought



A Good Citizen

Tunney all dressed up—a good citizen as well as a good fighter. His methods teach us a lesson.

He Won the TITLE

By ED VAN EVERY

os a professonal, you boxing writers thought I was pretty terrible. Probably I was, but I was keeping close take on myself, practicing and training ceaselesses. I learned sometaing new each time I fought and I realized that I was going ahead subjecting all the time

AND as I improved in skill, or A strength, in speed, in punching a shew to ring generalship, my confidence in myself increased apace. This confidence was founded on facts and logic I knew what I could do, and I knew a sat I could not do. Three or four years ago, for example, I would not have claimed that I could beat Dempsey. I knew then that I was a hundred percent better fighter than I had been when I was been in Army tournaments in France, but I knew, too, that I had a long way to go be ore I was ready for the log shot

"I knew three veers ago, nowever, that I was hig enough for Dempsey, which, you'll recall, was one of the essential details of my plans for winning the changements. I knew, too, that in physical condition, and ability to take ponodiment and recoperate, I was a match for any man in the world. My fight with Harry Greb in which be administered to me my only defeat and took away. the light beas sweight championship was enough to easy nee me of that. Grehgave me one of the worst beatings taken by a fighter an recent years. Thet he count not knock me out or ever knock me down So badly did he panish me that I collapsed in my dressing room after I left the ring. Let the thought in my in nd when I revived, and the one by standers tell me I voiced when I came



This is the sight-hand punch which Tunney practiced a case by and which really decided the championalisp in the first round. Asthough to actual delivery required only as inhuitesimal part of a second at really started for he rugged fact of Jack Dempsey fourteen months before the actual combat.

to was the couldn't knock mest it. I can be know

Having the size their and the showna, my next steps were the study of my opponents wenknesses and the acquisition of a knockout puncle. Somehow there always are med to be prevalent an opinion that I was not much of a puncher. Just why I never could see. I had knocked out men who had net the best of them without taking the count There were, for example, Bartley Madden and Tom Gibbons Frem when I knocked and Cabbons, whom Dempset intrees coulde't put away. The general opinion of fight experts seemed stall to be. Ohyes, Gene Tunney is a clever boxer and prefty fast for a big fellow shut he can t

"I THOUGH brong my opinion I, only on facts and some knew I had punch enough for Jack Dempses or any other man. What, though, was the weak spot in Dempses a armor? Where was I to land my punch to be must effective if I got the canner to meet Jack for the champsonship?

"I had been studying Dempsey's ring

ably he rushed out and whaled away intil some thing dropped. Against slow-moving big fellows like Williard and Firpo that system of fighting was nighty effective Against a shifty boxer though who wouldn't permit the chammon

prethods Invar-

init the champion to reach him with his deadly punches, the system didn't work so well. The late Bull Breaman, who was no great shakes as a boxer

shakes as a boxer stood off the champion for twelve rounds before

Dempsey second n

knockout. Tom

fight with high. Twenty-seven remain of fighting and the 'deadly punch of Jack Dempsey on a landed once! Why? Because on vously, Dempsey was not the superman that many people believed him to be. Fig it has his way, and yet were gone. Make him fight you goor way though, and he was no more dangeroos than the rank and file of heavy-weight boxers. That was my one—and I took it.

"I discovered, for example, that Denument model have

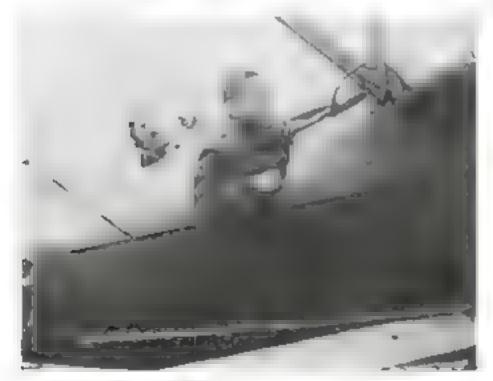
Cabbont lasted through a fifteen-round

"I discovered, for example, that Dempsey could be turned around very casely—probably because he modes forward on his toes. It was well known that lus most dangerous punch was a left hook. When I was training for the Dempsey bgit at Strongsburg Pa, mary people remarked law often my sparring partners reached me with their blows. 'If that s the best Thinky can do against secondrate boxers, they d say, 'what was happen to him when Dempsey lands on lum?" In fact, some of my sparring partners had the same idea. Only two men to my training camp believed I could bent Dempsey. Well, all I can say is that messely saw pay of my sparring partners reaching me with left hookel. That was Dempsey's blow; that was the punch I was traizing to avoid.

Now I knew that Dempsey when we met, we and do has atmost to knock me out in a purch. He was insuensely proud of his injuries is widep. And fourteen in oil is ago the thought occurred to me that the best possible way of treating Jack to a surprese wome, be by teverang the process. by my knocking him out in a punch.

"What a that? I exclaimed "Do you mean to say you actually counted on winning from Dempsey with your first

I del' said Gene positively "Dempsey was accustomed to seeing his opponents back away as he rushed them. I figured that by meeting his rush with a rush, and putting all I had into a single punch, I could knock him out with the first blow of (Continued on page 155,



Keeping Cool on the Eve of Battle

Tunney and Casty Jones, famous test pilot, fanding at Philadelphia from Stroodsburg the evening of the championship fight. Over the protests of his friends, he made the trip—his first one—is a plane.

How Many Words Do YOU Know?

Lawyers Use about 23,000, Mechanics 5,000 — Here's a Test for Yourself

You have, in the English language about a nothing words to clause from the express any idea that may enter your bead. Out of that indian you must draw the words to conduct your business, pass the time of day with your neighbors, or wide your love letters.

No or e-man knows all of the English vocabulary. The average man uses or ly a few thousand words. An intelligent artisan has a vocabulary of 5,000, A person of education knows from 8,000 to 10,000 words. A greater vocabulary than that is imprestionable evidence of a person of reality.

To test your vocabiliary and find out how you rate, a way that affords a chick Horner Vizetelly, managing editor of the New Standard Dictionary and dean of American lexicographers. He has prepared that of words so referred that, for example familiarity with all the 100 words in List A indicates a vocabulary of 6,000 words. It is not necessary to define each word exactly, a "speaking acquaint give with it is sufficient. If instead of 100, you know muchy five of them or any other number, multiplying by 60 will give your vocabulary.

combarly last B, with a 100 percept score shows that you have a vocabulary of 12 000 words. List C, a vocabulary of 25 000.



The man with the biggest vecabulary in the world--Dr Frank H Vier city, noted less cographer and managing ed or of the New Blandard Dictionary who deviced this test

Last A. For each of the woras I tore, you probably know 60 others. Therefore, it was know the eater 100, your combutary is along 6,000.

abate Afficin ample inqet n balk husk benefaction. brig browheat harn di emprice chemin chack chank. conneide command. componwie constraint. content on converge COLUMN CLEADING crutch

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jubiliant lygament musufold MOTORITY mesperat. matt DOGGCTI milb SILLE citiact overeight post pone preamble perjudice preside ргабеяв prixtude radical recommence. refuge сереся. PERCINE. folio)

seathe perminal. abatlow sheer shorm elemphic propert. DOUBTER statuary. nircent nt art aublime Buccuspb tale tenuity tenture t idal tenet topple trawl UNDER STREET, undergrowth រោប្រា uppush

List B. It you know ad of the 100 words becove, vanis vocabulary is about 12,000 Multiply each one you know by 120

administrator epicure alloy antipothy aqualine STEELING IS. automaton babble bedlam beeve blowge bounden brandish CAPBIVOTONS cervine. clandeatine congregate covet de.gn. dissonant. divolge disease ebon

crysipelas. excommunicate expandate. catenaute festoon form fluctuate fulminate gabble genter hackney handepilee hilarious huckster inadequate mflate invoke kunk Jangwid leaven. leonine liquidate longevity

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anum'tes

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acrunch

List C. An exceptional vocabulary -25,000 words is indicated by familiarity with all of the 100 rather uncommon words below. Multiply each word by 250.

abatemious
ague
amain
anneai
assiduous
barouche
hibulous
biasext le
biear
bole
eandid
catalepay
chapfalien

colory
condent
cordate
craniology
curvimeal
declivity
derogate
direful
d sparage
dory
drachma
dross

eloquence
emponum
farrier
folderol
frieze
genealogical
g be
heptagon
hoiden
hydrology
imbroglio
imperturbable
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millennum
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nape
nemad
nestrum
obloquy
ostracte
palmiped
paroxysm
penance
permutation
pestderous
phouphor

egrena

plantigrade
poise
polypus
portend
pugnacious
purge
quintessence
redundant
remuneration
replevin
sediment
acquiple

antiabub
modainty
spicular
spitile
springe
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mtored
suppliant
swob
syncopation
temporal
temellate

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toxin
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fyro
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vulet udinarian
vertex
vortex
vortex
toracous
wesses
xiphoid

Is Your House Heated Properly?

How Radiators Should Be Placed, Piping and Connections Planned, and Radiation Estimated

By JOHN R. McMAHON

YOURE a fine pair." I informed Rob and Juleu. "to leave the heating question to the last moment, when you are about ready to move into your new home."

Guess we don't believe winter was coming," laughed Rob. "Besides we got tangled up in that three-cornered argument about steam, hot water and hot

*Does it really matter the delay?
asked Ellen auxiously

"It is not deadly serious, I assured her, "There are advantages in planning about for your beating system and an early restalled furnace gives the medental benefit of drying out new passer and paint. But you re a lacky couple. The fact is, you are going to win by this delay.

Prices going down, ch?" quota Rob-"Better than that. A new accentifiinscovery that you can benefit by, not only saving your cash but adding to your confort.

"Who is the seigntst and what is his dope?"

"He is Dr. Charles W. Brabbre, a European expert who is now design heating research for a leading American corporation. He has a laboratory at Yorkers, N. Y., where he tames the flighty and clusive thermal units, practically making them eat out of his hand.

"The gist of his new idea is simply this More heat at the floor and less at the cui mg. A knee-high radiator, says he, does more useful work than its want high fellow of even larger size

"I always thought that ceiling best was not wasted, that it helps warm the next floor," and Ellen.

MNY people think so," I replied.
"and the idea may be correct
But Dr. Brabbee assures us that ceding
beat in excess is wasted. The Egyptians
and the Romans had the right idea in
putting heat ducts through their floors.

but we moderns have gone astray, he suggests, with our high radiators. We have been wroughy estimating heat in mere terms of radiator surface, disregarding the vital factor of low placement

Did the doctor test high and low radiators logether* asked Rule

'Yes one thirty eight inches high with another twenty inches high. The little fellow gave out eleven percent less heat on the old standard basis of calculation. but in its heating effect at knee height

which the seientist claims to be the true test of practical ethnicity it surpassed its big competitor by all of seventeen percept Add up nod you see that low placement will save you toward one third on your heating system.

Knee height does not sound quite scientific innerns Ellen

Flut is tens Dr Brabbee's decovery is not as exact as a chemical formula, yet it can be usefully applied. I would personally interpret it to have no radiator higher than twenty inches, or inder-window size, except where a nor row space compelled taker installation. You want a cool head and warm feet You get both by keeping down the source of heat."

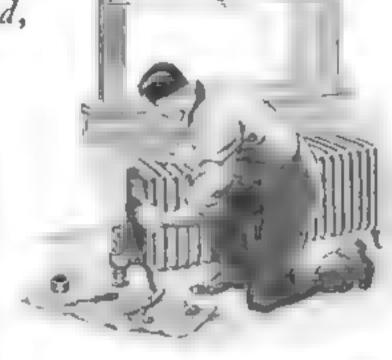
"I guest the promoters of hot air systems will claus a boost from Brabbee's work," suggested the young man

No doubt, in so far as the floor register conforms with the general pracciple of a low source of heat. Of course the heating question involves other important factors,—distribution, uniformity of supply, case of insintenance and longevity of the system

"Wot LD you advise hot air for our house?" asked Ellen

"Winter will advise and compel it as a horry up job, if you don't look out," was my maswer. The one-pape kind can be installed to a day compared with a week or so for a steam or hot water system.

"It is the least expensive of all outfits in first cost say one hundred and twentytive dodors put in Steam is at least double and hot water is still more ex-



Reductors wherever possible should be knot high. Low place ment will have you almost one third on your heating system

penave. Of course prices are deceptive when we overlook and, quably and service. Hot are is fairly detributed from a central register in a square house, but out to an recegular or rectangular dwelling. An old method of aprending the heat with large pipes is ansatisfactors, since the pipes are combined and perishable. Take the one-pipe kind or notice.

"Is it true that the modern but me furnace does not send smoke or gas into the noise" asked Rob.

It is relatively true. The namer sections are scaled together with furnace party, which tends to crack with excessive contraction and expansion of metal in fire contact, not water jacketed as in steam or hot water boilers. He news of puttying every few seasons is necessary.

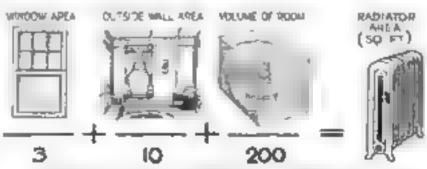
For soft coal a soud done of cast troumakes a tighter, more lasting job, while a steel done serves with anthracite and being larger, couts more lest. A fireput which has metal lugs or corrugations outside will manifestly throw out more heat than a plane surface, and it will also produce joint-breaking movements. Don't have a jug to a poke. Look over the farnace before it is covered with its gulyanged iron acket.

I suppose an oil burner can be used with a hot for furnace

Yes, but pack out a burner that makes little noise, because an open register or pipes couve) sound easily. Any furi from wood to oft may be used as a but air furnace. You can also heat water with a cod made the fire not."

"bpeaking of channey draft, what are the rules for a good one?" pursued Rob.

"For a small house an eight by eight much flue and a chimney height of at least twenty five feet are required. The next flue



How to figure the radiator surface area required for use room, interpreted, this diagram metas. Square fest of susdow area divided by 3, plus the equate fact of outside wall divided by 10, plus the cubic consens of the most divided by 100 equals the total radiation which is required for heating that room comportably

size is eight by twelve inches with a minimum chimney height of thirty-five feet. The flue should be used only for the furnace, not shared by the cook stove. Make the smoke pipe entrance air-tight with a muxture of ashestos and coment, half and half, mosstened to a putty. The chimney should project at least two feet above the highest point of the roof, no flue liming exposed above heickwork and no cap or cowl placed on chimney ton. Many houses show violations of these principles, and you can bet they pay the penalty in poor draft and waste of fuel

"HOW can I check up on the heating contractor who says I need a certain size of steam boiler? Perhaps that boiler is too lug, sut how can I tell?

"That is not a hard one for anybody who can add, subtract and mustiply. You have the right notion in wanting to verify the myso of the contractor, for your own satisfaction. There are several rules for figuring the size of a beating system, all based on seventy degrees made the house and zero outwide. They agree fairly in result. Here is a surple rule. Allow one square foot of pudiation to 3 sq. ft. of glass, drive to 10 aq. ft. exposed or outside wall, ditto to 200 cubic ft. of space

For example, a room Px15x10 ft., two mdes exposed, with three windows. has glass surface totaling 45 sq. ft., which divided by 9 equals 15; also \$45 sq. ft. of exposed wall, which divided by 10 equals 2214 sq. ft; also 1800 cm, ft. of space. which divided by 200 equals 9 sq. ft. Add 13, \$246, 9, and you have a total radiation required of 46 1/2 sq. ft."

"We have to do that for each room, I

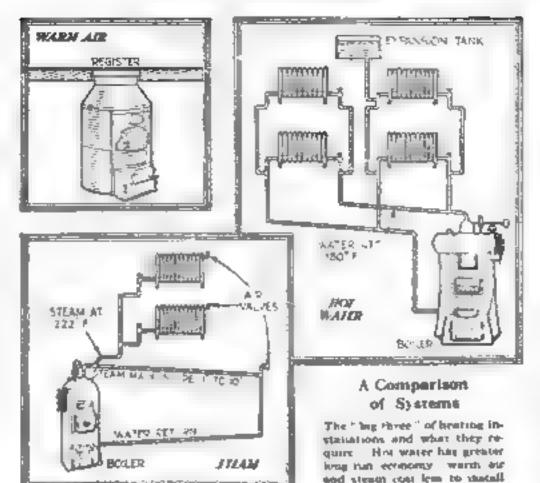
suppose," sa d Rob.

"EXACTLY. And you can figure it of inborously tupe-hang each room. Then add up the total, which amounts, tel us say, to 900 sq. ft. But this means ordy the radiator load, making most als a for the piping by twenty five percent, which raises the figure to 375 mg. ft.

To task we must further add a safety marges to cover such stems as extra cold weather, air lenkage, poor fuel, bad fiving, quick beating demands in the morning and the fuel-saving advantage of a furnace that is not pushed to the limit. The safety margin is seventy five percent for a weil built house. We thus double the figure for room total and nreive at a grand total of 600 sq. ft., which is the indicated size of our steam noiler. A table of boiler ratings issued by the manufacturer shows that the nearest to our indicated size is 625 sq. ft. That's what we want."

"I see a chance for an argument with the contractor over that seventy-five percent margin," observed the young man thoughtfully

"It would be better to consult a



Weather Bareau chart " was my conment. "If you have little or no zero weather in your locality and figure on some anythicy heating from a kitchen range and an open freplace, you can pare down the margin a bit. But suppose that you decide later to beat the garage from the house, or you add a room, then you may regret figuring too closely on botter some With a correct layout steam pressure runs from a few osmees to a maximum of two pounds in very cold weather. A size too small ozenis extrastuding work, more pressure, less effi-

DOES that rule on hoders tell anyothing about the radiators that should go with it?" asked Eden

"It certainly does, about all you need to know except the new discovery of Dr. Brabbee. The radiation for each room gives the radiator size. Take the roomin the example that needs 4034 mg. R We can look over a manufacturer's table and find what we want in almost a iv beight, length and width. Radiators are made in sections of one coll cach, so they can be as short or as long as you please. They are also made in one, two, three and four column widths. Naturally if merenses enpacty to multiply colurnus and by the same token more width-space is required at the wall

"If we use a two-column ramator twenty mehes high—which meets Dr. Brab-

> Are You Planning to Build?

MR. McWAHON S server and thuse of the Popular Science Institute of Standards are graduble to ment our renders an soleting their building problems. Letters will be answered free of charge. Write to the Home Service Department, Portland ECTENCE MONTHLY 250 Fourth Acentie: Ame York City

by a knee-high preference our exted room would need a radiator length around five feet. Of course we may divide this length u to two rachators, strategically placed. A threecolono, radiator twenty two mehes agn will do about the same work with a length of forty inches, while a four-constant of smaller height has to be only three feet long. We can't always exactly match our theoretical need with aims and style of radiators as manufactured, but we come as close to it as possible."

"T WOULD like one of L those low sizes under a wandow seat in the living said the young n estress of the home

Then you will have to add thirty percent to its cupacity to allow for decreased radiation value. The same applies to any radiator.

enclosed by a screen or grill instead of herm placed in the open

"What is the correct location of radiators?" asked Rob

"Between windows, sometimes under them, along a first floor starcase—always along outside walls rather than pistôe walls. In a room with two exposed sides, put the radiator in the forexposed end. The porth side of a linuse usually needs more leaf than the other sides. Never tuck a radiator behind an made door. If it have on discover that there is a mistake in richator distribution, you can correct it by taking away a few sections here and adding a few sections there Whole you can thus readjust without regard to boiler expanity, you can increase the total radiation only provided the boiler has a good uzed margin of power.

HAVE heard about the vapor sys-I tem," said Ellen, "What is it?" it is a choice variety of sleam outfit

Owing to a partial vacurat in pipes and radiators, obtained by climiney draft or otherwise, the slightest amount of hot vapor in the boder speeds through the system. Thus it heats rapidly, without pressure of more than a few ounces, and is noiseless-without any pipe thumps or valve statics.

"Being more elaborate, having more papes and a radiator surface perhaps twenty percent greater, the vapor aystem is bound to be more expensive. Why the greater radiator surface? Because vapor or boiling-point steam has a temperature of only two hundred and twelve degrees, but its temperature rises about three degrees for each pound of pressure up to a certain point. At three pounds pressure, steam is ten degrees botter than at the boiling point

"Does the ordinary steam plant need more than one pipe leading to each

radiator " asked Rob.

"No. For the average home the twopape scheme is in the diseard along with the overbead or down-feed method. There may be a 46 ontioned on page 15"

You Can Do These Tricks

Strange Effects You Can Produce to Mystify Your Friends



Where Did It Go?

THIS is a mystifying trick that can be performed at no cost and with little preparation. In view of the sportators you place a half doller in the paim of your left hand and squeeze at with your right hand tentil it apparently has been aqueezed into noth-names and disappears.

The secret, he revealed above her in a little mand dark of firsh cathred cardboard attached to a piece of clearly which runs up the sleeve, where it is necessary with a safety pin. The disk not time slide in amounted with adhesive war no that the copy stocks to it and then up your sleeve.

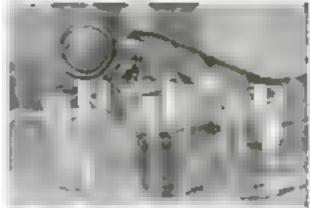
By KENNETH B. MURRAY

MAGIC tricks are a never-ending source of interest and fun, though their successful performance requires skill and patient working-up. These ax are unusually effective. Try them!

The Floating Hat

YOU can make an apparently quite normal atres hat chag to your hand and float through the air then suddenly deep to the floor to be picked up by the spectators and variety resembed for an explanation.

A first-reloced with thread does the trick. In in test around the het of the middle, ellowing borely sufficient slack to place the hand under, or shown in the illustration below. To page it to drop, break the thread by doubling up your hand. Concest thread while het is examined

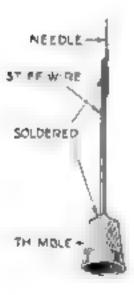




Water Changed to Wine

Principle was report of a mile buttle into process or water either changing to wine of the many was reasonable with, is a myst typing the many many than the many transfer.







The Bowing Cigar

A CIGAR on a hat can be made to limit proceedings to the company and even do a lively dence (above). Device used is at left. Your fager is threat in the thimble weedle point shoved through hat, and eight held on point



Making a Wand Rice

THE drawing at the right shown how a wand can be made to rior in the hand apparently of its own volition, in above. With thread around help finger the paper tube wand riots on the lead weight descends









A Mind Render's Secret-This One Needs Practice

ASETING may spectator to write a question, you place the question in an envelope without looking at it left, above well it, and light it with a match. Question can be seen, but not read, when match is held behind envelope what burning. Revertheless you then approach what was

written. Here's hew it is done: Cut a silt in envelope 'right-hand picture's and place paper in it. Speciator's question, however phases through slit into hand (center above. Duratay question can be seen burning when match is held behind. Road question while speciators witch the burning

Benjamin Franklin, Experimenter

BPLOW she will ser to be a ser to be a ser as all greated to be a series as a



This has paint ing by Charles E. Make portrays Frank in in one of his most attractive supports so edited and writer His upper so both was answered, because he writer as he talked, not for style but using words as a me change was his tools

How America's First Scientific Genius Pulled Lightning from the Skies, Daring Death to Prove the Truth of His Greatest Idea

By Archibald Douglas Turnbull

Franklin used tools, so in the hostness of life he used words. Wherever and however you take him, you will find hom using language as a mason used cement, as a bridge binder uses rivets or as a mot rest uses an accelerator.

In second be could describe an experiment even better than he could make one; with the result that men 'talked' back to han from every quarter of the world, often sending him valuable data for his experiments. Words were things to work with, to accomplish some definite purpose.

Think, for example, what his per could do, after he had stood for a under ght hour beside his window, looking at a sky as rosy as if the dawn were arready coming. Is it to be supposed that he could resist anything so fascinating as the Aurora Boreahs or, as they call it in the southers hemisphere, Aurora Australis?

The accentific study he gave to this phenomenon absorbed him. He watched the arch, or corona, appear in the northern aky, with its highest point just about over the earth's north magnetic pole. Then he watched that corona rise higher and higher in the heavens, with streams of varicolored light—white, red, purple, and, on rare occasions, even yellow and green—flashing up through the arch to form what the Shetland Islanders call the "Merry Dancers." Sometimes he saw a single streamer, growing brighter and heighter, more swiftly across the sky and fade away. Of course, he had to sit down and write about it.

Friends in all parts of the world began

to reply to his questions as to when and how this atrange and beautiful light rould be seen them captains, back from long crosses, told him that it was unknown in the equatorial region and very rarely noticed in may north latitude less than forty degrees. From Europe, his correspondents supplied him with results of observations from the northern countries, where the Aurora sometimes appears in long parallel mys, or curtains, billowing like a great flag tossed by the wind. Again, from others, he heard of the disturbances in the atmosphere, the terrific. unexplainable storats that sometimes accompanied these heavenry fireworks,

Living a hundred years too soon, he could not, of course, hear of the great storm of 1884 which paralyzed American telegraph and cable wires; burned up switchboards in Albany and Chicago, sent out corrects in Bangor, Maine strong enough to carry a message 700 miles over wire; and finally went off in a blazing Aurora over half the United States, all the Atlantic Ocean, and most of western Europe. Had be come down to our own day, his study of all these phenomena would have made it easy for him to understand that byword among ratho enthusiasts—"state"

From the scientific standpoint, Franklin was not long in advancing his theory to account for the Aurora. In the first place, he held that clouds carried electricity and that thes, under proper conditions, was a condensed out of them, much as ram-drops are. I pun the Arctic regions were heavy nee fields which, Franklin decided, must block off the electrical if scharge and prevent its entering the earth. "But," he had "the electrical fire can never be destroyed, from which at follows that this most accumulate in great quartery over the ice, as more and more is condensed, this accumulation must gendually fill the whole atmosphere of this Arctic region."

Now, under the heavy pressure coudstions understood to exist in these same regions, the layer or stratum of almosphere, according to Franklin, would be very thun or narrow. Above it, the vacaum belt must therefore "lining low ! And vacuum, as had already been a lown by experiments of scientists, was a good conductor of electricity. Suppose that the electrical content of the atmosphere became so great that the narrow stratum could no longer hold it: then it must "Running along the break through. vacuum. eried Franklin, "it will spread in every direction in great rays, diverging as they approach the equator—until the electrical fire finds a more temperate climate and an atmosphere through which it can penetrate, to enter the earth."

THAT was Frankho's explanation, a most ingenious one for his age and day. Modern scientists have their tabulations of Aurora observations in various

latitudes, their charts of "Amoral frequency," and their estimates of its height above the earth's general level at anything from eighty to 240 nules. To read them is samply to be convinced that fundamentally. Franklin was perfectly right. And none of them could beat him at a description.

THE idea that clouds carry elec-tricity led Franklin still farther afield in his investigations. We can get one leture of him, sitting at his library desk, making little postebo. d cloud models. Suspending t1 se from his ceiling, he hung down from them dozens of little silk threads, to which be attached has fastiful friends, the bits of cork or wood which had already helped him so many traces.

Generating electricity with losprimit ve machine, he discovered that the hanging "particles," when charged, re-peded one another. If he soaked them with water, they shook off drops as they flew apart -"exactly," said Franklin, "in the manage of ramdrops staken from the clouds monediately after a lightaning flush m a threder gust."

FROM this has deduced the throbing Alsory that two charged clouds "opposite is fire, 'create, when they meet in the sky, the thunder and lightning, and Dat the large raindrops so often seen were thrown down by the concusaon or nhock

Of course, we now know that the lagmandrops are not due to the thunder, but to the lightning itself. Frank in was wrong, there, as can be proved by a simple experiment. For instance, if steam is condensed in a large jur, it forms minute water particles on the sides. If an electrical discharge is sent into the par (s brush discharge, for example) the little particles immediately rash together to form hig drops which full, of their own weight, to the bottom of the jar. The same effect results from such a discharge among dust particles. This fact-that electric discharge makes finely divisled matter confesce or cohere—has been made

A True Romance

NEW and interesting light is thrown in this, the concluding article of Mr. Turnbull's series, on the famous late experiment by which Franklin first drew lightning from the thunderclouds Epoch-making as this achievement was, how many of us actually could tell any details of it? It makes as fascinating a tale as ever came from fiction writer's pen-

great use of in the development of radio telegraphy

To go back to Franklin's day, and beyand, to the elder Pluy-Pluy, in list Vateral History, about the year a0 a b., spoke of the "flames of light" playing around the masts and spars of the ancient Roman ships. These lights were popularly supposed to be sent by Castor and Pollux, the twin gods who watched over navigators. A pair of such lights was taken to be a sign of fair weather and a good voyage. One light always meant "Look out for storing and danger."

AGAIN, there were the Spaniards, as all good sailors are, in superstation. When they saw these lights from beaven, they decided them to be commations from the body of the body Sout Lamo, "Corposants," the Spansards eatled the lights, but they are much better known as "Saint Elmo's Fire. the common name even today.

In those carly days, it was natural enough that these phenomeon should have a religious or moraculous interpretution. But they depended, of course, upon one very important tlung-points. Mastheads, vardaries, church spires, and so on -all these are pointed. And it is easy to see how there shape supports Franklin s. earlier experiments with sharp bodkins or needles for "drawing off electrical fire." He began to speculate upon what might be done, in this connection, with the charges which he believed to be contained in the clouds.

TO SEE a vivid, siggag flash A seross the sky, and hear the distant muttering or the near-by crash that went with it, was enough to keep his currently on its toes. Posits -always possts; that was what impressed hun. He wrote to his friend Collinson, the English botan st "May not the knowledge of that power of points be of use in presers ing bouses, churches and slaps from the stroke of lightning, by directing us to fix, on the highest parts, upright rods of from connected by wire into the ground or, on a ship, into the water? Would not these draw the

electrical fire si ently from the clouds and secure us from that most sudden and terrable maschief?"

The lightning rod, of course—conceived even before Franklin was sure of the nature of lightness. These suggestions appeared in full in his letters which Colhuson made into the pampldet, "Observations for Explaining the Several Phenomena of Thunder Gusts." But one small paragraph of Franklin's own notes will serve to show how he was reasoning.

NOV. 7, 1749. Electrical fluid agreet with lightning in these particulars; 1. Giving light, 2. Color of the light. 3. Crooked direction. 4. Swift motors. 3. Being conducted by metals. 6. Crack or noise in exploding, 7, Subjecting in water or in ies. S. Reading budies it passes through. 9. Destroying amount. 10. Melting metals. 11, Firing Julianimable substances, 12, Sulphurcons March.

From that paragraph of a dozen steps, it in easy to see how he was building his theory and how, as always, he refused to jump to a conclusion. Some of what he and was accepted at once. For instance, Collinson, hearing that Frankin had killed a hen by electricity, tried the same thing on a turkey and reported that "it did cat assortimen tender



he declared. "We do not know whether the same property is in lightning. But, since they agree in all the particulars wherein we can already compare them is it not probable they agree likewise in this?" And there is a hint of Jove hunself all powerful Father of Thurderbolts, in the way in which Franklin, at the end of his notes, gives an order. "Let the experiment be made."

Immediately he proposed one method of making the test. "On the top of some high tower or steeple," he wrote, "place a kind of sentry hos, big enough to contain a man and a stand. From the middle of the stand let an iron rod rise and pass, bending out of the door and then upright twenty or thirty feet, pointed very sharp at the end. If the electrical stand be kept very clean and dry, a man standing on it when clouds are passing tow might be electrified and afford sparks, the rod drawing fire to him from the cloud.

THERE is nothing in history to show that Franklin was immediately overwhelmed by a rush of volunteers who wanted the first chance at this type of lofty sentry duty, which perhaps accounts

for Franklin's going on to say

"If any danger to the man be appeared though I think there would be none let him stand on the floor of his box and now and then bring true to the rod the loop of a wire which has one end fastened to the leads, be holding it by a wax handle, so the sparks, if the wire is electrified, will strike from the rod to the wire and not affect him."

This, with its provision for at least some insulation, was rather better. But on fortunately there were no proper towers or steeples in Philadelphia where the idea could be tried. On the other hand Franklin's usual free and easy way of telling everything broadcast—through Collinson—resulted in inspiring two

Frenchmen, who took him more seriously than the English Royal Society seemed willing to do at this time.

D'Alibard and De Lor, in a pleasant little Parsian garden, set up an iron rod, about an inch in diameter and more than fifty feet high. For days they watched it while not a thundercloud passed over their heads. Growing tired, they stationed a guard, armed with a length of brass wire and inder orders to call them if a storm arise. The storm did come and the guard, without waiting for any one, touched the wire to the rod.

Instantly there was a crash! Sporks flew in every direction. The ground thanking his time had come, fell to the ground. His friends rushed for a praest to administer the last rotes, but when they returned with him the guard was not dead. I pon that, the priest took up the wire and made several experiments himself after which he wrote a report to the two scientists, who seem to have missed the show after all. D'thourd then declared "Frankin's idea is no longer a reoperture but a reality.

Et ROPE, including the Royal Society was almost instantly convinced that lightning and electronty must be identical. Other scientists began to follow D the bard's example in making experiments, not always with happy results. Thus, Professor Richman, of St. Petersburg, erected an insulated vertical iron rod above his laboratory. By a metallic chain, also insulated this rod communicated with another in the ceiting. This latter rod projected downward and ended in a hall. The Professor had added an electrometer of his own, consisting of a thread hanging beside the uncharged ball and sustantly repelled by a charge.

During a thunderstorm Richman heat over to study his electrometer closely. At a heavy clap of thunder, a globe of blue fire, large as a man's fist, leaped from the ball to Richman's head, a foot away, and killed him instantly. The other man in the laboratory at the time was so stunged that he could hardly say, afterward, just how the shock had affected him.

With such convining demonstrations taking place in Europe, it is an odd fact that the only strong skeptic was. Frank in himself. It is not fair to say that he was merely chagement because he had not been the first to try bis own experiment, he actually was unconvinced by what had been accomplished. This was not uncharacteristic of the man, because his carefully maintained doctrine of never being too positive about anything often resulted in his having second thoughts" which appeared to him very much seest

TO HIM, the fact that a rod had been raised bity or a hundred feet suto the air and subsequently electrified that not prove necessarily, that storm clauds themselves exerted this exectricity keld that such a rod could not really reach even a low thondercould, which was sure to be more I can a britidized feet in the air. There could be but one way he insisted, in which and sputable proof the only kind of proof that ever fullysatisfied Franklin sould be bad. That was to send sometring actually up into the chards, to see if it would "extract the electrical fire Lorence at Franklin, as we are, from the standpoint of Lis contributions to science, this bringe as to him at his best and most famous.

He had already erected a lightning rod, connecting it to bells that would give automic. When Mrs. Franklin became abraned by the bells, he begged her to let them alone nevert reless. but he did show her law they could be cross-connected with wire, so they would "ring a outly". In his writings. Contound in page 158,

Pampered Salmon Get Elevator Service to Ascend Streams

ELEVATOR service for fish is the newest thing in the famous aslmon river regions of Oregon. The strange-looking structure in the illustration is a type of the new "fish lift" which probably soon will be a common eight on these rivers.

Instruct tells salmon, when ready to spawn, that they must ascend the stream to the farthest possible point to deposit their eggs. And salmon, when ready to spawn, always return to the stream in which they, themselves, were spawned. But the development of power projects for some years past has been threatening to make it impossible for the fish to ascend streams. The new fish elevators invented by J. R. Wheeler, of Reedsport, Ore., offer the solution.

Operated by hydraulic prespure, the elevator lifts the salmos (and trout too) automatically to the stream above a dam. About four lifts are made an hour, and judging by the crowded elevators, the fish appreciate the service!



Fish elevator at Winchester Ove. Shaped like a cylinder it is eight foot in diameter and twenty feet high. The salmon enter through the lower gate, are lifted, and exit through an upper gate

Eight New Tests—Try Them!

They'll Give You an X-Ray of Your Mental Machinery

FOU don't need to go to an intelli gence expert to get a line on yourself. Puzzlet can give you quite as accurate an idea as anything else of wast your forte is. I specially worked out for this very purpose are these ham Loyd puzzles, offered from month to month to the readers of Popular SCIENCE MONTHLY by the greatest puzzle authority in the world. You have the fun of solving the puzzle. And then you have the additional satisfaction of checking up on the time it took you to find the solution, and so arriving at a remarkably accurate rating of your almity at whatever the puzzle was derigaed to lest whether it was your mental agili y, manginative power, or similyl-Hall at ty

Here are eight new ones. Try them!

Solutions of Puzzles

THE correct solutions for the eight puzzles on this page will be mailed on request, at once, to any render. Address: Puz. ie Editor, Popular Science Monthly 250 Fourth Avenue, New York City.



Counting the Years

"HOW long have we been married? inquired McCarthy. His wife gave answer: "I've been tractied to you are a dozen years object has I, you have been my bushaped any elevenths of your aptitude in meetal arithmeter, note the tone it takes you to give McCarthy his answer in plain figures. Ten munutes gives a good rating.

Do You Grasp Facts Quickly?

IN ONE election district 7:00 votes were east for three candidates. The victor received 100 votes to every 80 east for his nearest rival, and the second candidate scored 100 for every 75 east for the third man. How many votes were east for the winner?

You have exceptional ability at grouping separate sets of facts in their logical relationship, if you solve this little poser within four minutes.

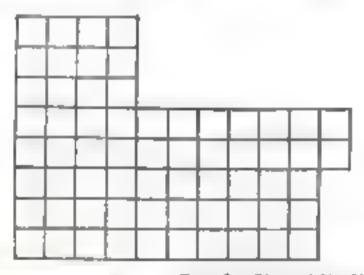
A Test of Foresight

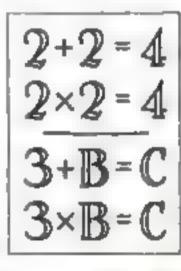
A DETECTIVE, or one skilled at picking his way among devices by-paths, will share at the test below. This pair of old-style spectacles can be drawn just as shown, by a continuous line which does not cross at any point. Copy the figure without taking pencil from paper and never crossing a line. Twelve minutes should give you a tigh rating.



Mental Carpentry

AN 8-by-8 square was cut into two pieces, and these two pieces were set to-gether to form the design at the right. You are to reverse the process—reconstruct—the original square by fitting together the two parts. You have good sense of form and analytical ability if you can do that in five analtes.





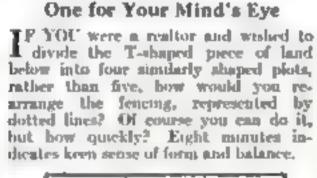
A Simple Trick in Arithmetic

THE two upper lines at the left show the only integers but added together or multiplied together, produce a like result. Now apply the same principle to the lower lines and flud the values of B and C. The mathematically included must should find the solution within eight minutes.



Jars for "Math" Stars

UPON the three shelves illustrated above are twenty jars of three different sizes. They are so grouped as in have the same jar capacity upon each shelf. If the smallest jar holds three pints have many quarts do all twenty of the jars contain? Time yourself! Seven minutes to solve this test rates you high in mental agility.







Building Up Words

IN THE lest above, you are to exchange one letter at a time from the second row to the first, each exchange producing a different three-letter word which eventually will cooler APE into MAN. The test is to work out the evolution by using the fewest pushille words ARE is the first step, what are the others?

Our Haphazard Roadside Signs

They Differ from State to State and Antiquated Styles Still Prevail in Dangerous Numbers -Some New Devices

By Myron M. STEARNS

cross arm "Stop, Look and Lesten" sign to tell the coroner it was a grade-crossing accylent.

Last winter one woman, driving at night tick heavy mowstorm, became confused when at the last moment she ouddealy saw a train coming. She furtied directly on to the tracks. By some muracle she got both the children she had with her out of the machine and prosped out herself before the enistreame. Luckily, also, the train wasn't devailed.

Many of the lessguarded by uny bende the track. On

(Left) Proctically the

atle protection for an Esetern grade cross-

ing. It doesn't tell

when a trum is coming

et-used crossings herenbouts are not thing at all except the old wooden creas arms, set close-

The motorasts' radroad crossing sign a hundred yards or so back along the boolevarid is, of course, used also That amazing descrepancy in warning devices between the East and the West. was driven home to me when I took my family across the continent from coast to coast. It was only one of a number of almost equally startling discrepances that we noticed that left me wondering

why warning devices and other safe-

gnards that have been proved highly ane-

that is used universally. Whenever a train approaches, a red disk starts swing-

org, a red light in the center of it is flashed

on, and a warning bell rings. It provides,

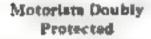
on the whole, a unglity effective warning.

cessful in some states aren't adopted in othera

TODAY, for instance, after the grade Lensong wagwing has been demonstenting its supersorty on the Pacific reast for something like lifteen yours, you will find in the Grand Cen ral Terminal at New York C.O., a flashing red light distalled, as a sample of what is advocated for use at all grade crossings. Been se of its sundarity to other working signal lights because of its lack of attention enteling motion, because it a so much see noteeable by day than at night, it is utterly inferior to the familiar warming of the West - How anybody can arly oracle at a rate tristent of the Wigging is

We left New York early at December Fighteen days later, going by way of Texas to avoid the cold, we were in Los Angeles. Two lumdred miles a day-and we learned a lot about motorists' warning mgna that fail to warn and safeguards that fail to safeguard Couring back in the spring along a more northerly route, we learned some more.

Signs and safety devices for the pro-



The mechanical Regman pronching trum by winging and ringing a beli. Out-of order a completions red blade drups into position, This idea is from California

N THE town where I live there's a steep hill, with a milroad track at the bottom. The main highway comes to trint hill, tuens down, and crosses the track bende the station. When a train comes, there's a great to-do. First, far away, you hear the engine howl. Then a gateman brows a warning whistle. Then he lowers the long gates, striped black and white. Then an automatic warning bell begins to ring. Then the express

roars through.

That looks pretty safe-for a railroad crossing. So it is, as far as any bland grade crossing at the foot of a steep bill on a well-traveled highway can be safein the daytime. But at night the gateman goes off duty. That doesn't stop the trains any, nor the auton on the highway But from the time the gateman leaves until he goes on duty again in the morning, it's a case of eateh as-eateh-can. Any morning you're likely to come down that hill and find a brazid-new automobile wreck paled up beards the rankond track. Last year there were five.

The fact that the crossing is protected. during the day makes it all the more dangerous at night, especially for drivers who use it often, because of the reliance you put on the gates.

Of course the train whistle and the automatic bell warning that was installed in the days of slower moving and less possy vehicles remain. Also, right beside the track, there's a big wooden



Dangeroon advecticing signs, leading to male motoruta daregard étamat warmings

the more used auto mads, during the last few years, small railroad erosung signs have begun to make their appearance, a hundred yards or so before you get to the crossing. That helps a little.

And where is this dangerous, antiquated district that I live or? Just outside New York City of you please, where there are more automobiles available for wreckage than about anywhere else m the world'

It a a condition, however, that's not by any means confined to the crowded metropolitan area around New York. H you li drive around a little you Il find motorists not much better protected throughout a good many of the Eastern states.

In the West, on the other hand, railroad tracks are guarded by a wigwag device that has now become commonplace m a number of states. On the Parific coast and throughout the Southwest,



A "dangerous bill" sign that occurate many socidents when couds are slipp-ry from ruln

tection and convenience of motorists group themselves under four heads warning signs and safeguards; route signs, speed laws and traffic regulations, and band signals.

Traveling across-country as I did. I was doubt quiled to find how much variation there is in all four of these classes, and how unbelievably far some states are belief others in adopting the best.

The warming signs and devices, like the grade-crossing signal a described above, are the most important of all.

ARYLAND was one of the first M states in the East to put white hues down the center of the boulevards at all curves. Gradually other states have followed anit until that particular safeguard is now widespread. But we found in Maryland, also, agas prohibiting parking at enries or dangerous spots where the waste line in the center was consulted necessary. Obviously a west precaution but have the other states copied Maryland in that, or in a lot of other sensible road regulations? You can answer from your own experience. Up in my neck of the woods, where the made are crowded with week-end gloryriders from New York City, you're likely to come ground a sharp corner anywhere and find half the road blocked by an admiring family watching father change

In parts of Ohio and some other midwest states, we found a hise running all the way down the center of the boulevard, instead of just at the curves. It was a decidedly good thing. Every time we passed another car we knew whether we were on our own side of the road, and whether the other fellow was on his. If you don't believe that's a help, try passing a couple of hig interurban bosses in Pennsylvania or New Jersey, or maybe a ten-top truck.

Other states, apparently, had never heard of Ohno's common sense line. When we left that section of the country we left that read-center safety line behind, and we never found at again until we got back there.

ALSO, in Ohio, we found in places a winte line at the edges of the road—one of the greatest safety devices for might driving you can possibly margine Why don't other districts try it?

When a state or county goes to an expense of twenty or thirty thousand dohars a mile—and sometimes more—for concrete boulevards, why begrudge a few bundred dollars for point and road signs to make its expensive road safe to travel on?

Road signs! There has been a tremendone improvement recently in regard to them, it is true, and the slow states, at last, really are beginning to try to catch up. Already many states have installed curve, crossroad, and other warning signs on all main boulevards; though they're slower at taking up the safety directions for stretches of road that require unusually careful driving. Maryland—one of the leading road posted states-has directions at the tops of all dangerous hals, giving, usually, the length of the hill, and telling you what gear to descend in. There are flashing lights and reflectors at curves and crossroads for night

Left Kanasa AMBL QV taken on chances. JANL NO her alona are resy BHEWSTER CA Bellin Dept. 18 Cangeman W Man-PAC 4 are also masked a April Puls New York The signs, however are W PERO me he compared as ad-NEW ORK es the Kunasa type PITALKIL A.SANY Water for ALC: Y 127 2 7 15 G North Billion Bend Acabert 9 8 1 4 CLE or wide se I se TO TA FM r 4 w 5 2 md FIN A PA ne agre at ne a hes a n c 4 md me el o harryer sumal in re d New Aturer We sup he A distribution of the state of are a de a de me de de you in soil other woods off the read Between In Texas er at house r ar alana ize ice modern Heine ein A 100 n C crt has been put to work have keeping motor on an again adout cond-

driving, and top-of-grade blinkers of a different color that supplement the day light warnings.

But have those sample, some precautions been taken in your vicinity? They haven to in name—nor in hundreds of other districts we passed through. You can slide over the top of that hill I space of m my own town, with the bad radioad crossing at the bottom, without a word of warring. You're supposed to know about it already. Our roads were made for us to drive on, and visitors use them at their own risk—or so we tell them, in effect.

Yet in California they put up signs reading: "Caution—Hill Suppery in Wet Weather." Signs like that obviously are not for motorists who know the hill, but for strangers who don't know it.

Road signs, in the old days, were put up high. That was so they could easily be read from the top of a load of hay, I s quest Maybe horses could see their names too, and the drivers of losses in cals. But notocia sit relatively near the read. A sign through them to read than one nix or eight feet up. Most of the states have already discovered this. Yet an amorning number of them still put the signs clear up in the nix for hay wagon drivers. Canfornin, though ranking with Maryland as one of the hest posted states in the Luon as still a surprising offender in this respect.

MISLEADING advertising ages tense serious needents and consequently have been legislated against already in many states. In others the danger still persists. Imagine coming down a boulevard to a age that reads—as many ages do—

STOP!

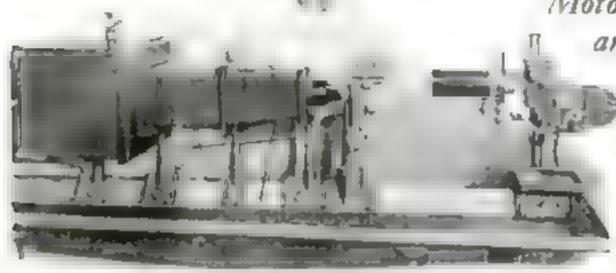
For Gas and Oil

You are rolling thrity-five, we'll say, and you pick up that STOP long before you see the little words under it. So you pull your (Continued in page 181)

Keeping



Motors Run by Cornstarch
and Bridges Sprayed
with Metal



Remarkable Camera Magniftes Steel Speck 15,000 Times

A world's record in minute photography was set by Dr. R. O. Guthrie of Chicago, when he recently magnified a partialle of steel 15 500 dismeters. The camera, shown above did not vibrate by a two thousandth of an inch during the bour and a half exposure.

(in these pages are presented each month besef doctes of scients fix a scorery and research havmy practical bearing on our everyday problems

Mystery of 500,000 Years Ago in "Missing Link" Skull

M ATERIAL for precing together another fascinating chapter in the atory of man's origin on each comes from front in Central Java. There Professor Heberlein of the Netherlands Government medical service has just discovered the complete skult of the strange manifes and apolice creature who lived half a million years ago, called by scientists pithecanthropus erectus, and popularly termed "the missing link

The latest duenvery was made near the spot where, in 1894. Prof. Eogene Doboss of Amsterdam University first found tragments in a scall cap, two tests and a lingly bone—of this enemest known creature resembing man. Senentials who have studied these fragments believe that pubecauthropus erectus was not a direct ancestor of man, but rather a cousin of the horizan race many degrees more homon than any of the manlike upes.

A study of the complete skull, including the ad-important skull base, may go far toward bridging the mysterious guif between man and the ape. At the same time it may serve either to substantiale or reject the astomating theory recently advanced by the German anthropologist, Dr. Max Westerhoefer, that the apes are really descendants of ancestral man.

Would Set Snakes to Kill Rats

If YOU are troubled by rate, gophers, are other harmful rodents, why not try keeping a pet snake or two about?

In experiments in the mological laboratory of the Kansas State Agricultural College, Prof. Frederick L. Hisaw and Howard K. Gloyd have determined that the bull make is death on rodents, and as such is a real benefactor of the farmer After a study of forty of these snakes, kept in large sunny cages, they found the reptiles to be "gentle, easy-going creatures, quite unappreciated." The experimenters put live rate into the tages of the "peta" and observed how the snakes captured their prev, and how much of such food each consumed

"A bull snake weighing about three pounds cuts more than three times its own weight in rodents in the course of our months," Professor Hisaw reports



How Uncle Sam Tests Plasters

Why do some wall place a link to prowhile others remote that the link of Standards experts are tog two to Different tends of place are appropriate setions on the laboratory was an area and are and tests are made to de a more through the gre-

Cornstarch to Run Our Cors?

Photing dust, it has long been known, may explode with considerable violence. Now hemee is trying to use the pime principle to find a new motor fuet. The photo shows Dr. W. A. Noel, of the Department of Agriculture, pouring communic into the intake of an automobile engine specially arranged for these experiments.

"This is equivalent to twelve anoth pocket auphers a year. One three-pound snake should be able to clear an acre and a half of alfalfa land of rodents."

One five-foot bull snake might save a farmer \$3.75 a year, he estimated,

Tooth Decay Prevented by Diet of Fish and Cabbage

BEFORE many years the dreaded visit to the dentat may be a thing of the past. In pasce of drillings and fillings to preserve the teeth, we may substitute an easy diet of fish and cabbage.

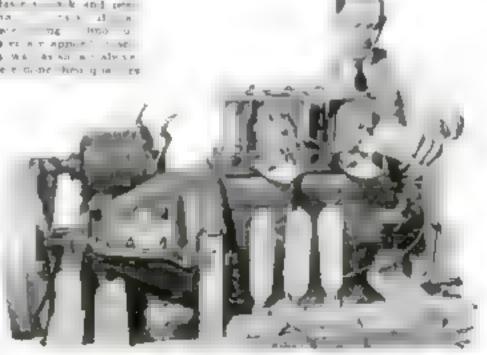
Such was the recent prediction usade by Dr. Bernhard Gottheb of the University of Victors to the International Dental Congress at Philadelphia. Tooth decay may be prevented by eating certain foods, he declared, and within five years the dentata hope to have enough scientific data to present a definite toothpreserving diet.

"We have found," he said, "that weight-giving food which builds up the body thence does not feed the teeth, and we have been trying to colate foods which will do so. Experiments with sea foods have encouraged us to believe we are now on the right teack."

He named cablage, brussels sprouts and sparach as other valuable tooth hunders besides fish, for the reason that they contain lime salts which are the basis of tooth enamel.

Cancer Called Nonhereditary

ONE by one the deadly decrees which affect mark ad fail before the advance of research workers and actenials who devote, and sometimes sacrifice, their lives to the cause of health. Now more than a hundred specialists from



eight countries have combined in unantmous agreement on fifteen important conclusions regarding one of the most dreaded diseases of all times—cancer

These specialists, including physicians. lineteriologists, surgeons, and experts on rad on and X-ray, met at Lake Mohonk. Y, a few weeks ago under the auspires of the American Society for the Control of Cancer Most important of their conclusions were

1. For all practical purposes cancer is not conlagaous or infectious.

2. Cancer itself is not heredstary

3 Surgery, radium and X-rays are the only justifial, e treatments for cameer

4. Cure depends on treatment in the

carlest stages

Cancer in some parts of the body can he discovered at a very early stage, and people shoust be on guard to recognize the danger signals. Dentists can help by knowledge of the causes of cancer, the experts agreed, especially with relation to superfect teeth and hadly fitting dental plates. Many lives, they cupl agived could be saved which now are sacrificen to unaccessary detay

Man Can Be Beardless and Bald -If He Wants To

THE time may come when men, if Tibey want to, can relieve themselves of the bother of the morning above and when women won't need to worry about holded nur any more.

That promise in beld out by H. C. Brooke English naturalist, as the result of experiments in the regulation of hair growth. Hair, Brooke says, is purely a matter of heredity. In his experiments he propered a strain of mice whose heads became baid in sixteen days. A few mays later they look the fir on their backs, and s little later all their last!

In terminy another scientist. Feet Popkus, may been firewing out pist what bappers in the life of a line. For seven years he kept a record of one of his bairs. He found that it grew only 204 days in a year. In summer it grew for 140 days, while in winter it rested after 144 days. In summer, he found, have get a quarter of an inch longer than in winter.

An Important New Steel

CTEEL that would be selt enough to I shape easily, yet with a surface hard enough to withstand the wear of moving



How Huge Cables Are Tested

Said to be the largest cable a se svice n world, this 1250-upn our



parts, long has been the dream of machine Heretofore the steel used in bindders moving parts has been hard throughout. and difficult and expensive to "work. Now a new steel has been produced at last by metallurgists of a Pittsburgh steel corporation, which has a soft core with a hard surface "skin." The discoverers predict that "jalcuse," as the new steel is called, will greatly reduce production costs and speed up output of parts for automobiles, washing machines and other basehold appliances typewriters, adding machines and inachines used in the mainifacture of clothing

New Rays from the Stars

CTRANGE rays coming from a certain S geoup of stars far more powerful than Neares have been descovered by two Swisserentists who henved the bitter cold of a mountain peak for a month to make their remarkable discovery. On the summit of More h Mountain, at an allitude of 13.405 feet, a small tent has served as obpervatory for Dr. Kolvorster and Dr.

Decalu, who despite the Arctic temperature have made unceasing astronomical observations, ending an the discovery of the

He Sprays with Molten Metal

The photograph at the left shows a metal gas burner being costed with "metal paint" by a remarkable new spraying process recently invented in England. The "paint" is spoond seround a large spool in the form of wire, which is melted and sprayed on the article. Steel bridges and skips, it is prodicted. will some be painted with metal by this cuty process new and as yet uncarred strange rave

These distinct governists hope to furness and me the extenoriously new mys f r acceptific and therapeutic purposes. The interesty of the cold finally forced the men to become to Interlaken, where they many known their discovery

The Best Buys in Meat

COME surprises, that, subsent the fault O values of trings we buy and eat recently have been revealed by experts on nutrition. For instance Dr A T Edanger, of the University of Missouri Agricult iral Experiment Station, who has made a special study of the American bill of fare, tells us that the cheaper, tough cuts of beef contain more value in calories than the expensive bits, and that in fact the "elsage | porterhouse steak is the worst buy of the lot.

He has found that a rib coast is more economical bank a loin roast, and that a cool or cluck produces the most boneless mest at lower cost than any other reasting portion. If your wife asks for a piece of beef off the "plate," he advises, see will get the best bargain of all

In general, he adds, it is best to buy from a piece of ment that is only meaning fat, for this provides the largest amount of protein or manele-building material.

From the department of milrition of the American Institute of Boking comes the interesting information that an ordinary ham sandwich, if topped off with a glass of mark, in 'a complete food "

In Air Mileage U. S. Leads World

AJHILE we frequently bear it said V that Europe leads the world in air transportation, in at least one point it is far behind the United States. Total air mileage in the United States over a period of a year now doubles that of France, the most active European nation in aviation.

This estimate comes from Archibald Black, consulting air transport engineer, of Garden City, N. Y., and is based on statistics compiled by the Aeronautical Chamber of Commerce. These indicate that air mail and passenger routes in this country, when a year's operation for all has elapsed, will approximate 6,000,000 miles, as compared with \$,000,000 indes covered by regular air routes in France during the same period.

Thrills of Modern Explorers

Sand storms and bandits make deserts still perilous Power from ocean tides How insects provide for their children Reviews of some of the new books

By TROMAS M. JOHNSON

"On the Trail of Ancient Man"

By Roy Chapman Andrews. Published by G. P. Putnam's Sons

IIE North Pole has just been flown over; Beebe has delved into the sen; the Roosevelts have climbed the roof of the world. And now comes the

story of another thrilling adventure of modern explorers, the American Museum of Natural History's exploration of the Gobi desert in Mongoha.

In his book, Mr Andrews, leader of the expedition, tells of some of its exciting experiences.

Bandita who attacked the scientists were routed by the charge of an automobile with cut-out open. Their frightened desert posses ran away, rearing so modly the bandits could not even unsling their rifles to reply to the shots from Mr. Andrews' revolver,

Another time the expedition was nearly buried by a sand storing swooging across the desert, "an

ommous tawny bank advancing at race horse speed." Trying to walk through it was like pushing into a "fantastic yellow wall, which gave and closed beamd as one advanced." Most of the party "rode it out" lying on the ground in the batterest tents, faces buried in wet cloths. Walter Granger, chief paleontologist, was buried to the neck in a pit. After an hour the gale dropped auddenly into flat calm.

Then, after camp had been shoveled out, the tawny cloud appeared again. This time it was a sand spout that whiled around for five minutes as if trying to suck tents and all into the vortex, then danced away across the plain. For ten days after there was pover enough calm to make it worth while to clean up either camp or campers.

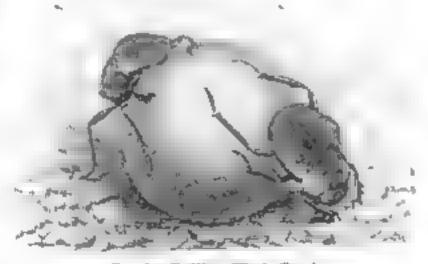
In late blay, two adventurers fought for three days through a blustard and its aftermath of anowdrifts to Urga, just after leaving a camp that lay drenched as best waves.

AT ANOTHER camp a swarm of possonous pit vipers invaded the tents at night. The snakes coiled about all four legs of camp cots, about shoes, and gasoline boxes. A Chinese chauffeur killed one, then picked up his cap and another fell out of it. Dr. Loucks pit his hand on one lying on a gun case. Luckdy the cold had made them sluggish. After dark all walked about with flashights in one hand, pickages in the other.

Andrews and Mrs. Andrews had a narrow escape from the shaggy black Mongoian wild dogs that feed upon dead natives and will attack the living. They awoke one night to find a grewsome circle about their sleeping bags. The dogs attacked one member of the party and he had to kill two.

Other anumals were more agreeable. Many of them were so curious they would chase an automobile to see what it was. In a short dash a gazelle could beat the

From Box Insects Live



Beetles Rolling Their Food

A devoted couple of stayphus beetles engaged in the task of providing food for thest family. The father apade down, is posting with his bind legs, while the mother clutches the ball, moving backward. Later they busy the ball

car, for it made sixty totles an hour. The wild asses made forty,

As a result of its discoveries, the expedition offers the conclusion that this is mother of the continents, whence reptiles and mammals spread to Europe and America. It predicts that "a relatively large-brained, erect-walking ancestral type of man" will eventually be discovered there, in proof that Asia was the chief center of buman origin.

"llow Insects Live"

By Walter Honeley Wellhouse. Published by the Macmillan Company

THEY live in mysterious ways and very interesting ways, according to Mr. Wellhouse. As witness, the sucred scarab beetle, valuable not only as model for the jewelry trade, but as the original pushball player, at least of the insects.

The grarab makes his own ball, of refuse, and about as big as an apple, and so bigger than himself. He pushes and pulls it mostly pulls it about, looking for a good place to bury it. When he does, he digs a hole, rolls the ball into it, climbs in after the ball, and plugs up the hole after him. Then be has a big feed, spending days and nights eating up the ball.

When all his buttons are strained, he comes outagain, to start a new ball rolling.

The female search beetles hade their eggs in similar balls and then bury them.

When the young ones batch, they eat the ball and then emerge into the upper light and air of competitive life, where they have to roll their own.

Stightly more grewsome in the trick of the digger wasp. It harnes its egg with two dead exterpillars, to feed the little unce. After harying the egg, it harmers

down the ground with a pebble. The conda lives in a bale in the ground, sucking sap from roots to get strength for a brief day on earth. Conkets, ands and knighted lear with their legs. These are only a few of the fascionting things this book teles of the actraging ways of insects.

"The Tide"

By H. A. Marmer. Published by D. Appleton and Go

CAN water take the place of oil?

I Does the rise and find of occan tides generate power enough to replace that of the American gasoline supply?

Mr. Marmer thinks that tidal power may some day become of real importance in properling a civilized and mechanised world deprived, in part or wholly, of its coal and oil. He is assistant chief of the division of tides and currents of the Coast and Georletic Survey, but says, nevertheless, that those optimists who predict that once the tides are harnessed they will make the whole world go, are winter.

Development of tidal power is not economically feasible where the average tide range is less than ten feet. Mr. Marmer finds; and development of large power is not feasible unless it is twenty feet. There are only fifteen unch places in the world, and only one of them is in the United States, the St. Croix River, Maine, Greatest in the Bay of Finity, the arm of the Atlantic separating the Canadian province of Nova Scotia from New Brunswick and the state of Maine. Here the tide rises farly to fifty feet in six hours, then falls again in another six.

THEORETICALLY, the mammum horsepower available where the tule rises ten feet is 7200 per square rule of tidal water; when it rises twenty feet, 28,800. So in a basin of twenty square rules and twenty-foot range, the theoretical maximum horsepower would be 576,000. Practically, only a fraction could be utilized.

The only system that holds possibilities of providing big power plants, we learn, is the basin system. It consists of one or more basins cut off from the ocean by dams. As the (Continued on page 163)

July Picture Contest Winners

First Prize

TO MAKE certain of finding on the mintakes of John and Mary and the artist in our July Picture Contest, Hamid Ecewart, of Sec. Diego. Cap built from odds and ends a model stateway and bullrony like the one shows in the contest pollure. " What a glomous unveiling of mistaires at the model programma. Be writen. Him completed hatidinovii came as part of his entry, and the judges have swarded him the first price of \$500. Mr Stewart is an insur unce exterment and lately reached his lift birthday



Second Prize

"Buch pairles as these are good to keep the cobwebs off the brain, says C. R. Heiper of Sturgia, Iduch, winner of the second price of \$100. Ide, Helper is a cubinetriaker whose diversion is pairle solving, "dichading with it, he writes, the added recreation of besting catputs, washing dishes, and mowing the laws.

Third Prize

The \$50 price won by Egbort C. Everest, of Plattiburgh, N. Y., goes to a worthy cause. 'I shall use it toward my daughter a college course, he tells us. Mr. Everest beades being an attorney, is quite a handy man with tools.

Others Who Share in the \$1000 Prize Awards



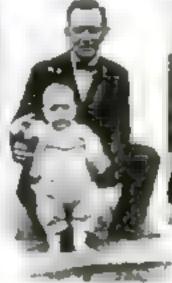
Mrs. John Krager, of Toledo, O. had a valnable assistant in her husband who, she says, "delights in tinkering."



Alfred T. Renfro, Belle vue, Wash., who won the first prize in our April Contest is back again a winner Here he is with his daugh ter enjoying his vacation



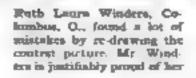
Having entered to his of the presence of the Contests & A. Olivin no. a the Contests of the Co



A Ol z nn s



benors, for we worked together "says Harry E. Samuelson, a presment in the Government Printing Office, at Washington, D. C.



Clement Burch, Journal III., proved to his own satisfaction the theory that the brain works best around midnight. That is when he found most of the mistakes.

An instructor arman-

Const Was Mart J

He sum he Conlest die all gunny

valuable suggest onn



deriving the content
of or the More
are to the pel, or
lender Fig. be ame on
the one of the arte
a self- through hours to
thinke but feet complete



"The Picture Contests," writes Carol Young Alwan from Mannespolis, Mann, "were an incentive in developing the power of observation." She is so artist.

Left The inventor in his still unfinished place. Be low, a rear view, showing the wings folded. The feature is designed to permit the place to be sended in a back yard and then run into a garage

New Airplane Built Like a GULL

Inventor Studied Long-Winged Birds to Find New Secrets of Power and Speed



BUILT like a sea gull in souring flight, this remarkable

L. W. Bonney inventor of the see gull surplant, holding sloft the stuffed bird he used as a model. He caught and studied many puts before picking that one as ideas in its propertions

new type of airplane was designed by Leonard W. Bonney, of Flushing, N. Y after a plaster cost of an actual bird. The wings, stuped I ke a guil's, can be folded back by pressing a hydraulic lever in the cockpit. At the instant the wheels touch the ground in landing, the wings are drawn back, placing the plane's entire weight on the wheels and enabling it, according to the theory, to be brought to rest within a few feet, even in a back yard. The ordinary plane must taxi across a landing field a considerable distance before it can stop.

Mr. Bonney's flying experience dates from 1910, when Orville Wright taught bun to fly Now 42 years old, he has been an avaiton enthusiast ever since. For two years he attached the flight of breds.

eonvinced that aviation still had many secrets to learn from their methods. Decolting finally upon

the sea gull as his model, he enight a large number of them, measuring their wing spread and the weight they could carry. One specimen which in every way measured up to his ideal requirements became the original pattern for the plane.

Swooping down to earth and landing with its wings folded the Banney Guil, as it is called, may be wheeled into an ordinary garage, so little space does it occupy in this position. Folded or extended, the wings are held rigidly in

position by gan locks. In fig it the mach he is balanced and guided by the flexible wings, which will adjust themselves to keep it on an even keel. A supply of gasolina is carried in a tank fastened to the outside of the plane at the front of the funciage, directly

under the propeller.

Within the body, the cabin resembles the interior of a motor car. A seat for two passengers is covered with a streamline top that enhances the graceful lines of the remarkable craft.

He'd Wrest Power from the Rise and Fall of Ocean Waves

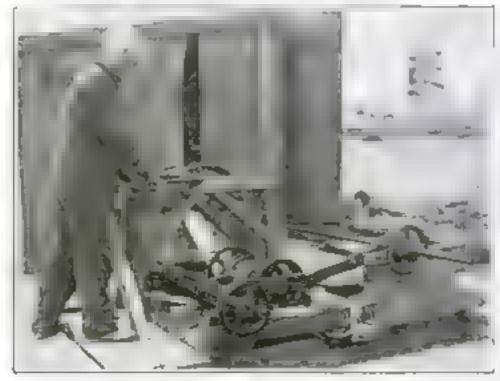
MACHINES that would utilize the power in the up-and-down motion of occan waves have long inspired inventors. One of the latest is the wave-barnessing machine illustrated here, and

its inventor, Arthur T. Adams, of Lon Angeles, Califo, is confident that a practical working type of it will make power as cheap as air or water. He has worked on the model pictured here for more than three years.

The working principle is a number of springs which are tightened by the constant up-and-down movement of floats placed upon the water. By operating the apparatus for five or six boxes a day,

the inventor says, he stores up enough energy to run it for twenty-four hours. It can be used practically by ships at anchor, he declares, or to operate danger arguals, buoys or lighthouses. With a machine developed from his present model, Mr. Adams has undertaken to light up a pier now under construction at Venice, Cabi

The floats used are shown at the right.





Floats that tighten springs as they rac and fall with occan waves are the basis of this unique "power generator." Left A. T Adams, the inventor, with the aprings. Right, The type of finite used

Latest Arc Welding Feats Amaze Engineers

Joints Made by New and Speediest Process
Fail to Crack under Terrific Tests

THE new method of welding by means of an atomic hydrogen flame rather than an oxy hydrogen flame—is him ed generally as an important advance in the construction method which lately has come to be regarded as the ideal and tute for the erroy riveling harmore.

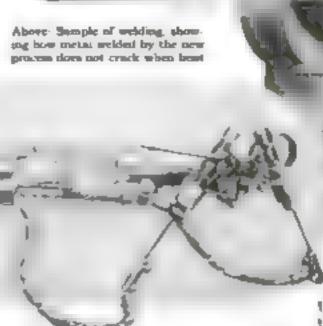
I ke many other important discoveries this evention is the result of research to an entirely different field. Dr. Irving

Langement found during inboratory in est gations for the General Electric Company that two atoms of his at genigas form og the more state ander leght temperatures. When they combined again to form the molecule, intense heat was horrsted.

The atdization of this intense heat became the basis for the new welding apparatus. The hydrogen is reduced to the atomic state by passing a powerful electric are between the two tungsten electrodes

in tell recting a jet of the gas in its normal no endar state into the arc. As the atom is by angen is blown out of the arc, the atoms combine into molecules and the heat generated in this way greatly in ereases the temperature of the loaning hydrogen. This heat is said to be fifty percent more intense than the oxyhydrogen flame now in use for welding.





Above: Welding a place of centing by the new atmide hydrogen process. Left: Close up of the mech, showing the two electricies

to the gas applied to the electrode type, a quantity is ejected to surround the parts to be welded. Thus prevents the formation of exide or a tride films which make the ordinary are welded metals limite.

Welds made by the new apparatus, it is said, do not erack or break under the twisting and bending tests and are made for more rapidly

Magnetism Now Detects Rail Flaws That Caused Wrecks

The gas is supplied to the electrodes,

which are in contact when not to use and

are adjusted by a acrew, through a fune

in the handle under a pressure of less

than a pound to the such. In addition

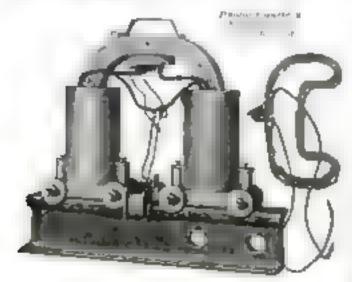
WILLE defective rads are known to be responsible for desistrons rad road wrecks involving large bases of ble and property annually, until receitly there was no means of detecting the historians of the rank which caused these catastrophes.

Now a Japanese engineer, M. Suzuky, brings forward an invention perfected in the Japanese Government Ra Iways at Tokyo: to defect such internal defects as transverse fissures, segregation of impurities, and so on, in rads. The defectionoge, as it is called,

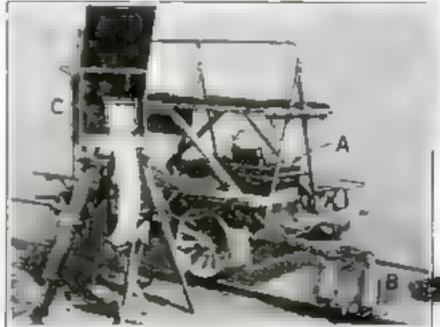
detects these flaws by magnetism. It consists of two parts as powerful electromagnet which creates a magnetic flux in the section of mil under test, and an exploring coil working on an entirely separate current, that records any variation in the magnetic flux. This is the brains of the apparatus.

So long as the flat remains constant, as at will in a perfect rod of uniform cross section and density the exploring coll will be electrically "dead" and will show no reading on the attached galvanometer, an electrical instrument for measuring in note electrical instrument. If a flaw is encountered as the magnet rolls along on its own wheels, the magnetic flux will anddealy drop and return to normal again, inducing a current in the exploring coll which the galvanometer records. In this way the sligatest flows may be detected before they become dangerous.

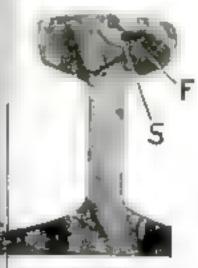
with the outst about 100 radican be tested in an hour.



How the electromagnet is placed by means of fullers on a rull to find hidden flaws. The exploring coil, between the poles of the magpet, is shown as emerged view at the right



The defectuacope in action, assumed on its car and in gosttion on radway tracks. Electromagnet B on the rail recurves current from butteries A. C is the recording apparatus



Section of a red abrowing a had aplic and transverse finance. Hidden flavor run casily be detected by the defector open

Ingenious "Gun" Splits Logs into Cordwood



Log-aplitting gust, already in undergo in form ing and lumbering regions of the Porthwest

Foresta Sown from Airplanes

TWO men scattering tree seeds over devastated land from an arritane can accomplish as much in one and a half linurs as two men working on the ground could in tex years, according to an experiment conspeted by the Army Air Corps to Hawatt. A large area devistated by fire, where seeding by band was found unpracticable, was replanted in this way

Three trips were made over the barned area by an Army aviator, carrying twenty

four bags of seed.

Musical Tree Plays Christmas Carols

out winding.



tree six feet in beight

His Plane Won't "Crack Up"

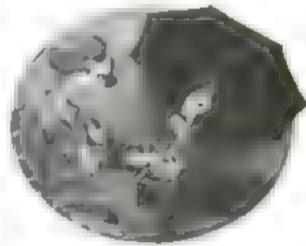
TWO novel safety features were incorporated by D. E. Dunlap, seronautical engineer of Dayton, Ohio, in a new airplane recently designed by him. Two pusher type motors are used, placed at each side of the pilot, and the nose of the fusciage is rounded off, so that the plane will anaply roll over instead of breaking up and crushing the pilot and passenger under the weight of the engine in case of a bad landing.

ANY large tree, after being felled and sawed into four foot lengths, can be split up easily and quickly into cordwood by the use of a remarkable new instrument known as a splitting gun.

The "gun" rescables a heavy metal pm. The driving end as solid and the muzzle end, which is slightly tapered to facilitate driving, is bollow. About a teaspoonful of black blasting powder is poured into the hollow end, and after a fuse is fitted, the uplitting gun is driven into the end of the log. The protruding rear end is supported against a heavy piece of wood.

Driving the gun into the log tightly compresses the purcler, and when it is fired by means of the fuse the gas is driven forward and its expansive force blows the log into at least two pieces.

Ordinardy about two amoutes are required it is said, to load the gum, drive it and set it off



Umbrella Folds in Vanity Case

DEING overtaken by a sudden shower D is no estability to the woman whose vanity case is this latest novelty from Germany, shown above. Face powder, p iff and rouge rub ellows companionally with the handle and collapsible ribs of an umbrella. When folded, the umbrella fits compactly into the top of the case.



All That Makes a Phonograph —Less Than Two Inches High

The phonograph E. of paper o region sor in b in

ten nbre

MALL enough to be carried in a cont o pocket the remarkable little phonograph above is the product of an English factory. Its dimensions can be apprecasted by comparison with the average ause disk record shown. They are: dumeter, four and one half inches beight, one and three quarter inches. and weight, two and three quarter pounds. In all essentials, it is said, the little instrument follows the construction penciples of the ordinary talking nucline

Building Stone from Brick Waste

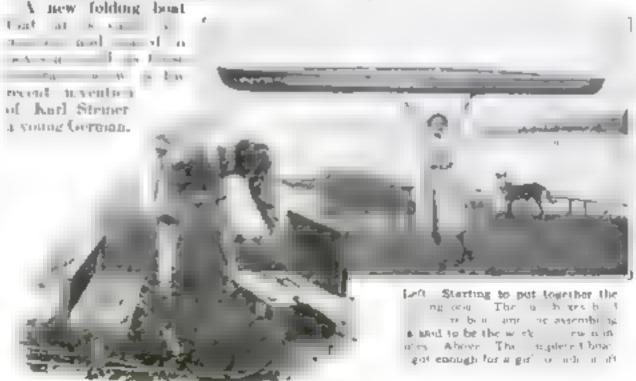
BY A new process for making building stone from brick waste invented by two Swedish engineers, the waste bricks are first crashed to anad braps and offer The finer part is ground to a powder, moved with line or cement, and water added, making a mixture the consustency of a plastic meriar. To this is added the comese material obtained from the first granding of the bracks. The resulting mixture, when dry, is said to be an excellent aubstitute for natural stone.

AT A BOTEL in Berkhampstead, England. recently, twenty couples danced to muse: which could not be heard by the speciators. The mosic was broadcast from a near-by radio station, the dancers earrying their own radio receiving reta, equipped with small inconspicuous bondphones.

New Folding Boat Seats Two Rowers

YOLDING boats have long been popu-I lar in Europe, where it is no uncommon sight to see them being curried from one to another of the many small rivers.

The framework is of steel, covered with canyus, and the entire boat, folded or ready for launching, is said to be light enough to be carried with case.



Cuff Link Watch the Latest Style in Timepieces

"HtS latest mode of wearing the A watch has been introduced in Germany as a substitute for the wrist watch. It is a cuff link timepiece, and fairly necurate in spate of its dimensione size it is claimed. One advantage it has over the wrist watch is that the shirt sleeve doesn't have to be drawn up part way to the elbow in order to see where the hands are pointing The link on the other side is burged, and filds flat against the connecting bar to permit easy insertion through the button-144 (26)

Searchlight Stops Auto Thefts

Police official of Worester, Mass., recently announced that the number of automobile thefts in their city has been cut in half by the use of a huge 30-nich searchlight of 45,000,000 candlepower.

This light is placed on the top of a tall budding, where it can be seen a long distance. Officers are instructed to watch for signals flashed by the light whenever a theft is reported, and to go at once to the nearest patrol box for details of the robbery. The light then is turned on the section of the sty water the theft occurred, as ling in the capture of the criminal

Giant Camera Snaps a Whole City at Once

ESIGNED for Army ter Service work, this huge serial camera is being tested by Lieut. George W. Goddard at Dayton, Ohio. The lower end shown in the dhistration houses the largest photographic lens of the high speed, anastigmatic type that has ever been ground. The image recorded on the film is now enches aquare,

At an altitude of \$5,000 feet, the lens would produce an image showing a city the size of Detroit to he about three and one half meher long.



Lieux G. W. Goddard and W. Oswald with the buge camera



Broken wire is held with places as illustrated above while the growing device splices the foose ands

Wire Splicer Designed for Telephone Linemen

THE broken strands of telephone or Lother small scres can be spliced in a few momenta, it is said, with an insterment invented by Niel Kjeshii of Sover-Creek, Wash. A short piece of steel is deilled and grooved so as to catch the broken ends, which are then twisted into a spike. The investor clauss has device as adaptable to the preds of telephone toes. men who have to work in awkward posttions on the arms of telephone poles.

The splicer is slipped on to the line at the point where the broken strands are crossed and held, and one of the ends is caught in the groove. When the meterment is twisted, the broken end a brinly sphred. The operation is then repeated with the other broken end

Machine Shows "Dub" Golfers How to Putt

BECAUSE so many golfers, even expects, ere weak on the putting green. P. A. Vinle of Cluengo, noted sports authority, has perfected a practicing nurchine which, he declares, forces one to go through the difficult putting stroke in perfeet form. He also has devised new executing apparatus to develop the golfer's muscular strength and control.

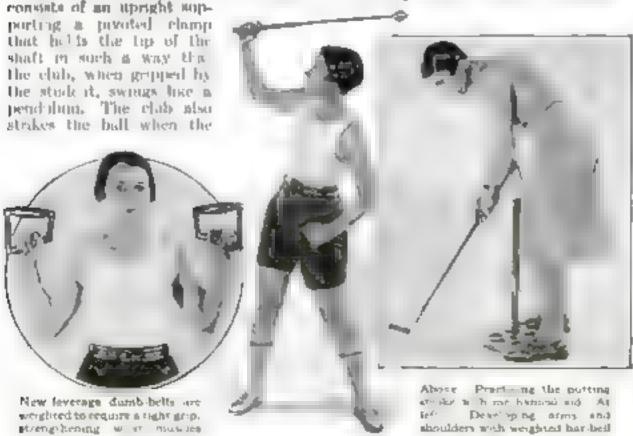
The putting machine, at the right,

consists of an upright supshaft m such a way tha

priengijiening war musies

shuft of the club is at right angles to the direction the ball should take. Thus, meeording to Vaile, is the only way to impart a true roll or "run" to the ball

Other new apparatus includes special leverage dumb-bells (at the left), which are weighted to require unusually light grib and so develop the wrist inuscles, and a bar-bell (center) with an adjustable weight. to develop shoulder and arm muscles.



Pipe "Tree" for Young Climbers

THE play in-. Mactinebile dren asually demands satisfaction in elimbing one thing or un-A tree uther naturally is the enost tempting chadenge. As a substitute. for back yards where no trees grow, a California manafacturer has devised the next best thing, which he calls a "chinbing-tree " It as a framework of



mined pipes formed with a central "trunk" and a series of "branches." one above the other. There is little danger of a fall, or torn dresses, or heuses. Guardruls protect the ends of the "branches."

"I have completed six ship models described in the Popular Science Monthly Home Workshop. Four were Barbary purate ships which I sold for an average of \$45 each, and two were Spanish galleons, sold for \$125 each. W J. HAZLEWOOD, TOLEDO, ORIO.

Automatic Die Caster for Small Lead Parts



One men can operate three or more of these machines with very little effort.

A Clock That Acts as Secretary

FOR the man with many appointments and business calls to remember, a new type of clock for the desk provides an electric secretary always on the job. The rim of the dial is slotted for every quarter hour of the day, and a metal cop inserted in the proper set mances a busing remember. A slip of paper bearing a memorandum is attached to the clip when the alarm is set.

How Much Do You Know of the World You Live In?

YOU know more than the average, if you can answer more than half of the following twelve questions selected from hundreds of queries sent in by resders of Popular Science Moscrium. The correct answers appear on page 103.

- Where are there oil wells underneath the sea?
- Where is the center of population of the United States?
- 3. What place in the United States has the longest days?
- 4. What are the floating gardens of Mexico?
- 5. How fast does the Gulf Stream flow?
- 6. Which continent has been least explored?
- 7. What is the Tower of Loudon?
- 8. Where are messages sent by drumbeaus?
- 9. Where are the speaking statues?
 - 10. Where do people eat earth?
- il. Where did kings wear feather cloaks that took a hundred years to make?
- 12. Where do ferns grow as tall as trees?

IN THE remarkable new automatic die casting machine pictured at the left, invented by R. H. Williams, of Detroit, wheels and generare substituted for the tuning needed to produce die castings such as storage battery grads and other

small lend articles.

Molten lead flows through a valve controlled by the timing mechanism. After the die is filled it is kept clused long enough for the lead to barden, and then opened. The battery god is ejected from the die and carried out of the machine by a moving belt which stacks the grids in an orderly pile. The timing control then closes the die and the operation is repeated as long as pig lead is fed into the melting tank.

Because no attention is required except the feeding of the lead, it is possible for one operator to take care of neveral nuclinies.

The numerone is genred to make two bundred operations an hour.

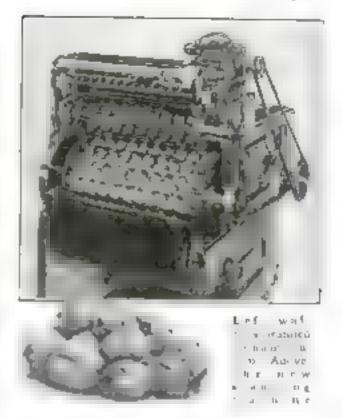
Pocket Lamp Held Like Cigar

Hel Deady in the mouth and switched off and on by the lips, this handy little pocket lamp leaves both hands free



As a dark room lengt for photographic week

to work with The battery for et is curried in a vest pocket. It is especially practical in fine work for which a direct. beam is peeded. or for work which must be done in darkened rooms, mich os photographie developing. It was invented recently in Germany.



Brands 2,000 Walnuts a Minute

CALIFORNIA grows more than nearlyeight persent of all the walnuta grown in the United States, and the problem of branching these millions of nuts to identify them from all others has long perpresed the nut growers. Receal's the machine above was selected from 200 devices submitted in compet tion.

The nutsure stamped with printer's rice as they pass under the spange rubber dies on a revolving evinder. The caps on the ryboder are singe crough to boot all a sea of rats. The stamps are inkert with each revolution from a rober above the cylinder. Sponge rubber dies necessariodate themselves to the size of the not and the stamping pressure is light enough to make a legible imprint without cracking the shell. It points 2,000 auts a naminter

A zew source of paper is shortly to be exploited in Northern India—hambon. Extensive tests have shown the feasiblety of converting hamboo into paper polp by treatment first with sulphate of soda, giving unblessived pulpt then with bleaching powder, producing flushed pulp.

The unloader consists of a cylinder

Mechanical Arm Unloads Logs from Cars

To UNLOAD lost from railway cars anto the null pond, the ingenious steam-operated muchine below was invented by M. F. Crawford, of Natalliany, La., where it was recently placed into

service by a Louisiana lugiher company. The work of unloading the heavy logs from the cars which brought them from the lumber camps into the mill pood formerly was done by men equipped with prying books. By that method, there was always a constant danger of crushing or празиния.

track parallel to the loaded car. The track parallel to the loaded car. The tany, hook at the end of the extension rolls the unto log forward off the load at a single stroke.



Extension book pushing the logs off a car into the mill poud

Yardmaster Directs Switchmen by Radio



tion of its new yards, the Illinois Central Radroad at Chicago installed a radio microphone in the yardmaster it tower. An amphlying system of eleven

loudspeaker units and as many morephones is scattered about to the varils. Instead of sending orders to switch men by means of runners, the yardmasser toward at his desk and gives the asser the radio like voice as he mades orders is amplified many times over, and his directions reach the ears of the men loud and clear.



Odd" Watch" Tells Time by Stars

WHILE the fact that the stars apparently revolve about the North Star is known to nearly everyone, it remained for Frederick C. Meacham, of Garden City, N. Y. to work out a simple way to link up this "motion" with the hours of our bine system.

As shown in the obstration above, Meacham's device consists of a thin disk in the center of which are privated two pointers. On the inner circle of the disk are printed the months and days and on the edge the hours of the clock.

To tell time by the stars, one of the levers in set to the day of the month. Then, with this lever point of directly at the ground, the disk is held a few number from the eye in such a way that the North Star can be seen through the center. Then the other pointer is moved around so that it apparently touches the two stars that form the side of the bowl of the disper opposite the handle. If the observation is carefully made, the pointer will indicate the exact time.

A haprementative ore vein of considerable and cand value was reported discovered recent a near the out Toya-Mayan names in Turkestan, Assatic Rassas.

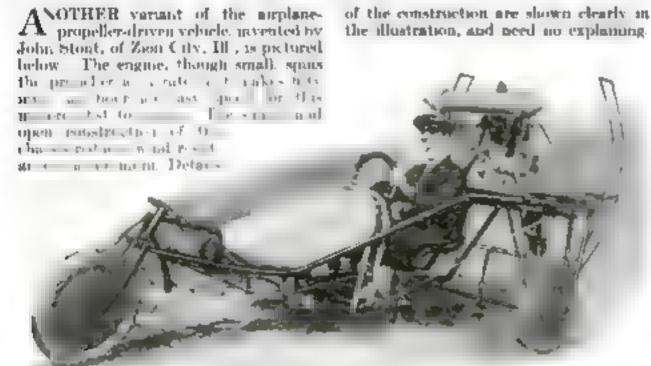
Chemista Wear Glass Uniforms

PLATE glass overalls, masks and gloves have been designed to protect chemical workers who handle seids, powders, and other corrosive and inflammable materials. Banding together the material with copper ware insures flexibility.

It's Hammer and Wedge in One

HANDY for opening bours and other mean around the house is the combination barrings and wedge above. The shape of the claws makes it possible to lift a and straight up. Its construction solid steel from end to end, gives strength necessary for hard prying strains.

Motorcycle Driven by Airplane Propeller Blade



For speed on land as well as in the air the simplane propeller is finding many uses. Here's the latest

Know Your Car

TESTS have shown that balloon tires as they are now made will give as good service as the high pressure cord tires, but long indeage can be obtained only if eace is taken to keep them up to the proper pressure.

All auto tires gradually lose the air that is pumped into them. The rate of leakage usually is faster in bot weather than in cold. Most motorists are in the habit of pumping their tires up to the recommended pressure and then letting them. more until they see the tire getting flat. A better plan is to pump up the tires at regular intervals of once. a week in summer and once every two weeks in waiter. Put in a few more pounds than recommended so that by the end of the period the tires will have dropped only a pound or two below the proper pressure. Watch these points

- Pump your tires at regular intervals.
- Always pump in three or four pounds more than recommended.
- Make sure that your front wheels line-up properly.
- Use your brakes as little as possible.
- 5. Keep away from curbatones.

Raising What the Germans Scuttled

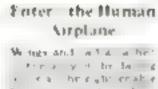
The German warship Hindenburg was bright in the solar te en into be decided of Scope Film Solaro The ship he was an hige promise army he was entire to be I feet go as a restrict a power was a very age of the a contains of the type was feet.



She Mayes in Artista Urcles

A sea by the property of a company of a property of a property of the property of the sea of the se

The Uncommon



We don't and a help for a year her with enable to a help with enable to a help me hera year. The history is a help we have the help were the help were the help with the help were the h

The Newest Ball Game

A rage to past entry entry had green that a control of market a serial a control of each a control of each a control of the serial and the latest a between the serial and the latest a between against a control of the series of the series and the series of the series are a control of the series are a control of the series are as a control of the series are a control of the serie

Patience on a Pedestal

Anyone an module of materials for an analysis of the first of the grown be made by puring rogether some 740 bits of take of the grown and with the grown and with the grown and with the grown and with the grown and grown



to consumple a busine or his dare deviaquaptant in abor of He is be unled prece that in a 45 top whele wor his cought off Los Angeles, is being owed in his port.

What a in Ope Warship's Magazine

Commencement of death of a ked row on row was ing for he next win the ske is south on he beings below where he administration of any night wantle point in S.S.L. and The base best staff in near any administration on the sky point was a fact Charlestown No. 1. If



He knowle og dram a new Ford and ur ing rium in all die silme an ingelin in well e silm in the Kin in Terms re in line at his military nervice and I is per noting to a little and residence fish.

Run of Things

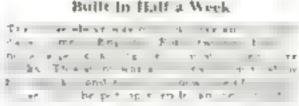


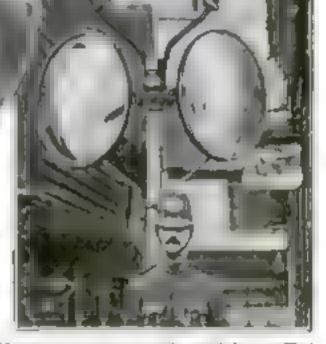
Here is the purpose of a source of the sourc

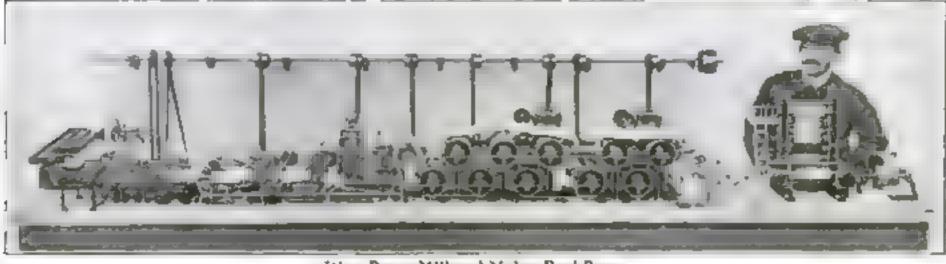


Caught in the Act

When he walls on a light a Long Brach by a collegeed been reconstructed gauges on the special The result was the example of the photo above although a reward the country of the special speci





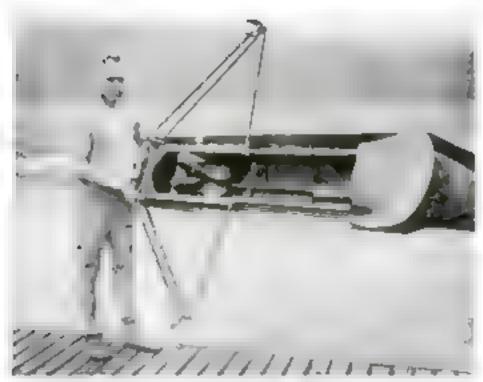


It's a Paper Mill and Makes Real Paper

Actual paper four inches wide comes off the last rollers of the minuture paper mili above, made in France. Students in France often take special courses in paper manufacturing, which is a chief industry of the country.

A mechanic spent twelve years making this model which measures about ten feet in length and received a medal at the Lyons expansion. Each of its tray parts works as smoothly as those on a machine of regular elar

Famous Oarsman Invents New Single Shell



C. S. Titus, former rewing champion, substitute his new shell equipped with skiding foot rests and perforks. The sent is stationary

A NEW type of rowing shell in which the usual shelling seat is made stationary, the foot rests and oarlocks sliding instead, has just been designed by C.S. Titus, of New York City, once a champion oarsman.

Titus contends that the studing of the sent shifts the full weight of the rower's body so as to interrupt the smooth progress of the shell. With sliding foot rests and ourlocks, on the other hand, only the weight of the rower's legs is shifted.



Cycle Side Car Made from a Wrecked Toy Auto

Take the chassis of that wrecked toy automobile you beight for your youngster last Christians, attach a spring or two, and a cycle wheel, then fasten it to a breyele, and you have so ingenious side car vehicle, says William S.B., of Chisesand, who made the one illustrated here for his two little girls.

The thevele requires some remodeling in order to accommodate the aide car, and there's quite a bit of work to it, but, take it from Dorothy and Roth, above, it s

worth at 1

New Movie Camera Records Sea Wonders

A PICTORIAL record of under-sea life off the Florida coast in being made by Dr. Paul Bartsch, curator of molloska at the National Museum at Washington, by means of a new motion picture camera constructed under his direction. It is water-light, and can be regulated as to speed, or forms, as ready as on land. The tripod holds it steady against the action of the water

Ohye of and a diver's belief are all that Dr Bartsch needs in his work at the bottom of the sea. Hitherto, petures of this kind had to be obtained through elaborately formsteed diving bells or ginsawindowed chambers which were let down from chartered ships. This method proved too costly for extensive work. With his body greased, and air supplied to his belief from pumps above. Dr. Bartisch expects to be able to work five hours under water at a stretch, at depths ranging from ten to thirty-five feet.



Dr Pool Barturb, of the National Museum. hedding his new dishuserum movie camera

Dividers and Pencil Combined

THE combined dividers and pencil shown above make at possible for the user to take his results and record them in a note book immediately without removing the instrument from his hand. Each leg of the dividers carries clips for supporting a pencil, while one of the legs carries a larger clip to receive the forefinger of the user. The device is the invention of F. L. Sorensen, of Farmont, Mon.

Detecta Factory Shocks

AN ENORMOUS seismograph recent ly constructed by Dr. E. Rothe at Strassburg now part of France, is an sensitive that it records quivers in the earth caused by machinery in factories more than a mile away. The instrument, which weighs mineteen tons, magnifies earth vibrations two thousand times.

Auto Awnings the Latest

ADJUSTABLE awamass and protect
passengers from sun and
man are a novelty in
act module accessories
Rigid construction stops
rattling or flapping, the
maker claums. They
swing with the doors and
are attached quickly.

Today's Winds Could Run Our Factories 400 Years

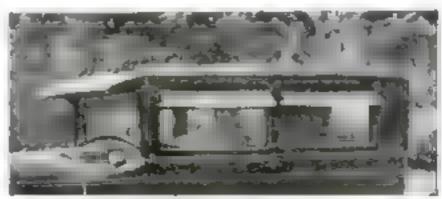
AT ANY one instant, the enormous coergy stored in the winds of the world a equal to a hundred mation indicates power hours, coungly to run all the factories of the United States for more than 400 years, if it count be hardened and draws upon as needed. Today this vast power is almost wholly unused by men.

These actourshing calculations recently were made by Edgar W. Woodard and anonsmood by the f. S. Weather Bareau.

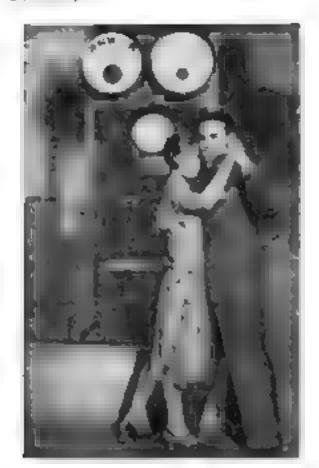
The power of the wants Mr Woolard says, a being used up continually by the friction of the masses of air against each other and against the surface of the earth. These losses, he calculates, are about one thirtieth of the total power each hour. If the supply of energy were not renewed, naturally the wind would cease to blow it is renewed by the heat and light of the sun absorbed by the atmosphere.

The winds are described as a great heat engine, absorbing solar power and using it at a rate of some three in dion nellion horsepower. If some practical waid motor could be devised to use even one bundredth of one percent of the enormous wind energy, it would give us enough power to replace all the engines and dynamos in

the sould



A closed car equipped with the new removable awaings



Ballroom "Clock" Beats Time for Dancers

DANCERS and orchester can keep perfect time with the dance speedometer pictured above, a new ballroom navelty consisting of two dials for counting the beats and indicating the correct rhythm. As the pendulum swings, a small hammer taps the little drum underneath, so the municians can follow the correct time by eye as well as by ear

A Concrete That's Like Coral

"GASSING" concrete to give it added high these is a movel piew recently reported from Sweden.

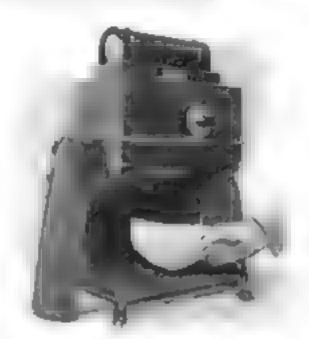
While the concrete, a nurture of sand, gravel and cement, is still soft gas is in troduced into the mixture. This has the same effect on the concrete as yeast has on bread, filling it with small holes. The concrete so produced, it is said, is just as strong as the ordinary product, but much lighter, requiring less steel to support it.

Piece of Cork Inflates Life Belt Automatically

A LIFE-SAVING belt that goes into action automatically when the swimmer gets into trouble is a new invention recently reported from Austria—the creation of two Viennese mechanics. The belt remains deflated until the actual emergency arises, when it inflates, bringing the person to the surface, it is said, within ten seconds.

This is accomplished by means of a cork attached to a rod which governs a valve. When the awaimer sinks, the cork is drawn upward to the surface, lifting the valve. Air is thus released from the container, where it is compressed, into the rubber belt

The device is light in weight and is designed so as not to interfere with freedom of movement an awarming.



Lamp Exposes Counterfeits

PICTURED above is the remarkable quartz lomp recently invented in Germany, the powerful ultra-violet rays of which are said to reveal fakes and forgenes in paper and fabric. The light exposes differences of color and texture, it is said, and is being used, as shown above, particularly for the detection of forgenes and counterfests.



The life belt inflated. Ordinarily it is word collapsed, permitting freedom of movement

Slot Machine Sells Clean Towels

DROPPING a coin in the slot and receiving a towel in the newest adaptation, recently patented, of the famour vembing machine. The coin releases the shaft about which the towel is rolled, and a clean length may be withdrawn.

The shaft is permitly held in position by a counterweighted backing lever, preventing the withdrawal of a towel. When a cone is inserted through the usual slot, it falls into a leax on the locking lever, which is thereby rocked to release the roller shaft. A catch prevents the roller from turning more than the length of the towel until a new com has been inserted.

Pipe Joints Made of Rubber

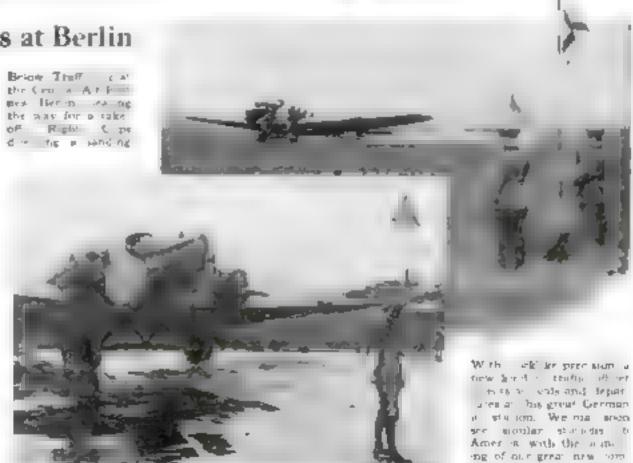
ONE of the most remarkable recent applications of rubber is the manufacture in England of flexible paper joints. These rubber joints are being used for jupes currying water, oil, gas, and so on, their chemically resistant properties giving them, it is used, special advantages. The paper are joined by rubber rings, making a tight, flexible just t

men all aviation programs

Planes Need Traffic Cops at Berlin

CONGESTION of the sir at the Berlin terminals of European air lines has reached such a stage that it is necessary to station men to direct traffic at the landing and take-off points. These aerial traffic cops are equipped with standards and flags to signal and direct the planes and to prevent accidents.

The photograph at the left taken at the Central Air Port in Berhn, shows an officer holding up other traffic to give a plane a clear right of way for departure. The two other cops are stationed at a starting flag giving the signal for a landing. Though operating now on a gigantic scale, the Berlin air port amazes visitors with the clocklike precision with which the arrivals and departures are managed. Airplanes are constantly landing or departing—for Paris, for Poland, for the South. Hours are rigidly fixed and strictly adhered to. The place huma like a bechive, with all the pleasant excitement and bustle of a great railroad terminal.





Dr. W. W. Coblemts of the Surpay of Standards showing the new plans serves

Walt Paper Removed As Easily As Peeling a Banana

SEVERAL seasons' accumulation of wast paper layers in an average-size room peel off like magic in the space of two and one had hours, according to the makers of the wall paper removing machine shown in operation at the right.

It works by steam. A steel plate is pressed against the paper, and ateam penetrates the layers through its perforated strikes, loosening the paper so that it can be seraped off with a kinfe. At the same time the fine needle-apeny of steam is so d to channate dust and kill germs. The process leaves the plaster clean for immediate equipering.

The steam is generated in a steel lader and raised to an eight pound pressure with generated the kerosene being kept in a copper tank and to be proof against fire or expression. For recling work, a spream device his around the whist and over the shockler of the operator to save him from back and dionider strain.

Vanity Case Banks Milady's Pennies



Powder puff rouge, mirror, and smell change

IN THE lid of the vanily case at the left is the usual square nurror and the compart ment for powder and puff in also of conventional design. But the

maker has ingeniously found room for a small core bank shaped so it will fold into the heartest ancient of space—thus leading one more duty on this already overworked article.

Clock Operates Electric Switch

A CLOCK-DRIVEN switch to control electric corrent, shotting it off or torning it on at any predetermined time, is the invention of H. F. Schoenman, president of an Eastern firm of manufacturing pewelers. The switch contains a mercury-filled tube actuated by a clock. Rocking the tube causes the mercury to flow to one end and close the circuit.

New Glass Protects Movie Actors' Eyes

MOVIE actors and actresses need on longer (car " kleig eyes" from the powerful studio lights, it is reported. Bureau of Standards experts have developed a remarkable new glass said to protect the eyes from harmful ultraviolet rays, such as are radiated from the movie studio are lamps.

Dr. W. W. Coblents of the Bureau is shown at the left with the new glass screen, which will shade the lights. The glass contains cerum oxide, an element such to absorb the harmful cays without affecting the power of the light

In order to make use of the new acreen, a slight change will have to be made in the light itself. The earthon electrodes in the arc lamp will have to be white or yellow finne producers, and the photographic films will have to be sensitized to the yellow and red rays.



Steam ageny prosetrating the thick layers become the wall paper from the plaster

Hor sparses that exist in great numbers under the city of Budapest, Hangary, are being used for the first time experimentally, to heat the city's buildings.

Blue Coloring Matter Made from Old Pots and Pans

OLD from utensils have been of little use except as junk until a new method of using them to make a blue jugment of high commercial value was discovered in England.

The old trop is thrown into a tank of sulphure send, which converts it into sulphate of from after treatment in another tank. The final solution results in a blue pigment, which is used to make newsprint paper white and aik an interestibleck

The photograph above shows the ison in one stage of its conversion, when it is turned into wonderfully formed, yellow colored crystals of prinsiate of potash, which adhere to strings dispersion the tank.

Incubates 500,000 Eggs at Once

THREE malion baby checks a year is the output of a California hatchery, where the ancubators lave a capacity of 200,000 eggs, thirty tens of Licar, at a time. Electricity is used Diroughout, to turn the eggs automatically six Lines a day and to maintain an even temperature of 103 degrees. After twenty-one days, electrically operated gears open the long line of incubator doors so that the new checks may have light and air,

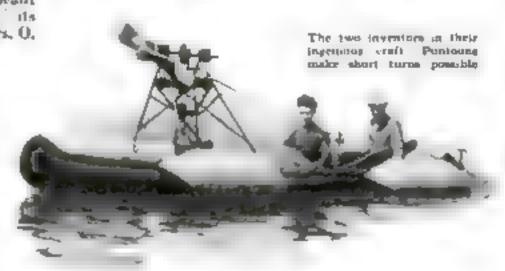
Canoeists Use Airplane Propeller and Pontoons

ONCE it was a cance, but sance it acquired a motorcycle engine, an acplane propeller and a half dozen pontions, the add-looking craft below has had a tough time trying to identify itself. However, it is meant

angentous inventors, O.
L. Swanson and
Herman Lannemann of Peoria,
Ill., claiming a
speed of fifty
noles an hour in
their novel craft.

"for speed only

The set pontoons, there on each side, are designed to keep the boat from turning over on sharp turns or in rough water. With its lightness and the shallowness of its draft, the canoe can invigate rivers not practical for the motor hoat, its inventors say. The canoe measures sixteen feet and the motor has 25 horsepower.

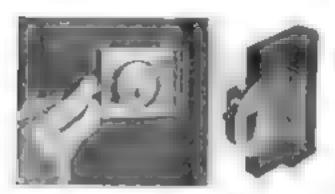


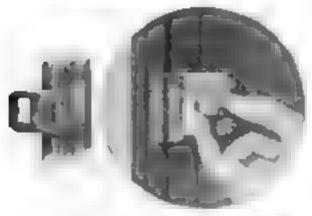
Spiral Garage May Solve Our Parking Problem

TORELIEVE the congestion caused by parked automobiles that has become a serious problem in large crites. Samuel C. Lancaster and C. O. Hjermstad, of Chicago, have worked out a novel way to build a garage that could conveniently park a tremendous number of cars.

Instead of building the floors level and and then using elevators to lift the cars from the street to the various floors, the new garage would have a floor in a continuous spiral from the street to the top floor. The cars would climb around and around the spiral under their own power and coast down.

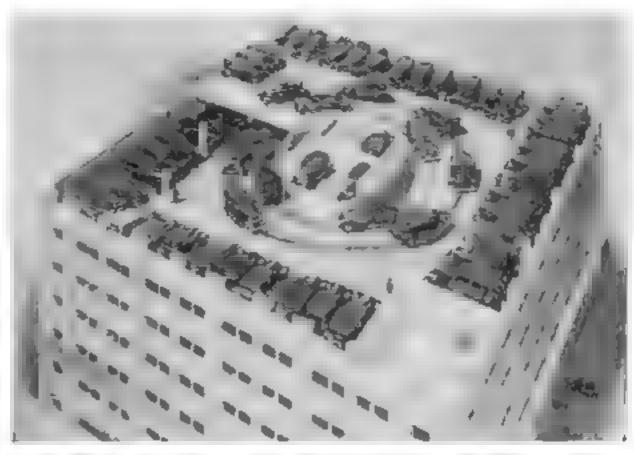
A ten-story garage built according to their plans, the inventors my, would house over 300 cars if erected on a plot 115 feet square. This would be equivalent to the parking space along both aides of a city atreet sixteen blocks long.





Above: Heep and escurcheon place of the new lock. Below: Inside door-bolting device

A NEW ELECTRIC prospecting instrument in being used by the Ontario Department of Mines to indicate the presence of gold deposits—not so much to locate new years, however, as to survey known areas.



Plets of the proposed spiral parage, showing how the double driveway would allow free and easy movement of care, on their own power going up and counting down. Such a garage, it is mid, sould be empired in accumum minutes, as compared with five hours for the life type

Locks That Foil the House Thief

TWO new styles of locks said to be virtually burglar proof have been designed recently by a New York inventor. The hasp, as shown in the upper illustration at the left, has a flange that is mortised into the door jamb so that it would be impossible to up out this plate without practically destroying the door. The escutcheon plate of the lock is designed with a raised ring of metal ourrounding the cylinder, as indicated with the pencil, to prevent the using of a cold chuel to break off the front plate. The made of the lock is east with protoberances that engage with the cylinder and prevent its forcible turning.

The same principles are applied to the impile door bolt in the lower pictures.

Egos and now dipped, for preservation, in an oil bath maintained at a temperature of \$35 degrees F Mail mags and dropped 3,000 feet from airported without damage, it is reported, by a new method decised for European airways. The device is sieget, but is said to be a parachute operated by clockwork. Wayside stations are planned for receiving usud delivered in this new way.

It Lifts Heavy Stone Blocks

ESIGNED no a labor saving device for binide . industries he t 1 , S. Bureau of Standards. this straclifting coniravance does not need a double grop; it is paugged into a small hole or the surface of the stone, where it estelles with a grip sufficient to hold the block firmly while it is being fraus-



Lefting heavy block with the new hook

ferred from floor to truck or vice versa.

Old Trolley Car Now a Lunch Wagon

WHAT becomes of old trolley cars? Are they rebuilt as the busses that in many places are displacing them, or simply scrapped as pink? New Jersey, at

least, finds a real use for them by converting them into lunch wagons. Beveril are now placed along the main shore linghway leading to the New Jersey coast resorts.

Concrete blocks support the body at several points. A counter with atonis in front of it and the usual cooking apparatus fit mugly into the space available. and a string of electhe lights placed above the windows attracts attention. Comfortable and cican, the cars do a rushing business during summer.



Berapped, when the busies came, this old traffry cur is flow serving businy Jerseyites as a convenient randolds lattch whight.

Device Cleans Grain by Vacuum

VACUUM-CLEANING grain to remove annut and light dockage is the job performed by the "Bates aspirator" the invention of E. N. Bates, market specialist of the Department of Agriculture. Grain thrown from the threshor elevator is spread in a flowing stream down the sides of a low flattened core, while a suction from above draws a current of air upward through the tion layer of grain, cleaning out the lighter material.

Inventors' IDEAS That

A Kitchen Table Becomes a Laundry Tub



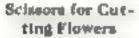
Table Conceals White Enamel Tub

The we pust termbove above two views of he same pure of the them to the action of the same pure of the transfer of the event be used as a bosto to The transfer of the major about antique of the same of the same

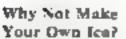


Filtered Coffee Must Seep Through Pad, Too

Freed offer the death of the many a few other elements in the state of the many a state of the contract of the contract of the state of the contract of



It is possible to hold a flawer below the point on the stem where it is to be cut, and snip the stem without the flower a falling to the floor with the new sensors above. After the curting edge does to work the stem is grasped, becamby by the sensors



Six minutes is all it taken for that abuse mechane at the right to make ups, according to its German in ventor. A "cold tainture made according to a given tempe currounds a continuer building water. The cover is accorded on the apparatus is shaken nightly and theo let attend apparatus. At the left is a smaller size of the freezer.



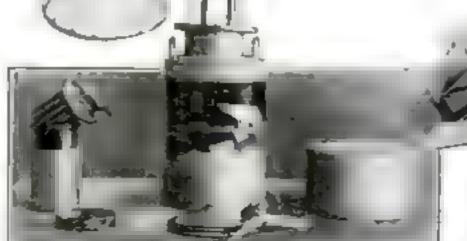
A strew cap, threaded to fit various shaped continuers, keeps the sugar in this bowl deft, always covered, protecting it from the assoults of wet spoons. The sugar pours out in a thin stream through a small spout. The device can also be used for certain varieties of succoshed cereal foods.



Cores and Cuts at One Stroke
Just a little pressure and the fruit corer above

Tender Steak from Tough Cuts

A high school boy of Ads Okla., invented the jugenous device above for taking the toughness out of beef atest and other leathery cuts. The steak is run be tween the shruded railers

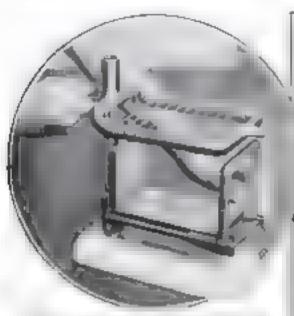


Potato Baker Folds Up

Potations based to a toothsome consistency by the device above are said to be uniformly "done" dry and mealy. They are impaled on the cight promas and hong over the fire or set in the oven. The handle regulation the promas

Are Easing HOME Tasks

and a Pocket-Size Machine Makes Ice



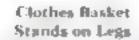
Sikes Butter Into Small Squares

Are no bur if the extraction in a very congau vague, portione, with our relot above. The butter is placed on the lower place and the device is slid buck, the two crossed wires quartering it. Then the top port is pressed down, and the hor south wires divide each quarter into ten equal parts

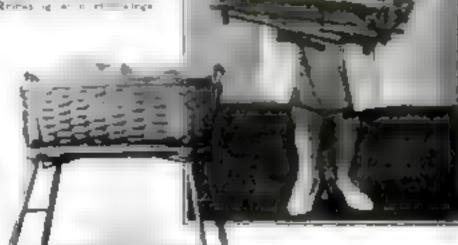


A Holder for the

The ice pick can always be hept at hand yet out of the reach of children, when a hadder hise that above in provided for tilt heeps the pursusharp and free from rost too

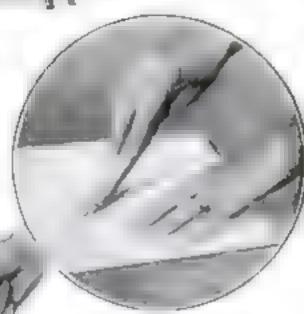


Friday less on the week because on the world of the world



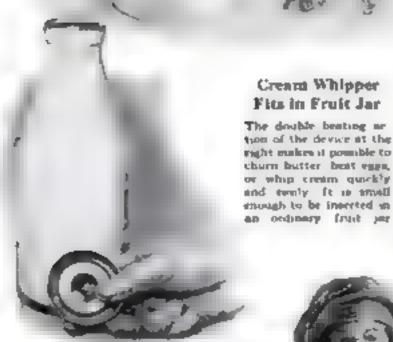
Boiled E44 Set Sures Fingers

Object transportation of the hot building from the feetle to the table without burning the fingers is possible with this how butht left. The frame work holding the besting eight lafts out of the bettle and dries at once all credy for the table.



Glue Tube Seals Itself

There is a tip of our tribbet on the murilogatube above, and the paste flows through a vertical shi to be applied on the article. After the job is done, the tube is sealed by the hardening of the murilage in the opening



It Opens Milk Bottles

The curdboard rap on a milk bottle is removed easily by mesta of a proof on the under side of this metal milk bottle cover 'above'

Cuts Potato into Ribbons

This regeneous cutting tool right clamped to the hitchen table, will cut potatoes and other vegetables acto long spiral ribbons for facey cocking. In the picture, the potato is lying flat against a disk lenter which slices it as it revolves.





Three useful features are incorporated in the bulle tool above in all mich rule in sharp edge for use as a letter opener and, in one end, a small magnifying glass

Tuning Up Your B-Eliminator

Tips on Adjustments That Will Save
Overloading Your Tubes and
Insure Good Tone

By Harrison Lewis



Cotyect setting of the variable resistances that control the voltages supplied to your set as important if you want to obtain good tone

IN EXRLY stages of the designing as presers were confronted with two important problems. One was to find a reliable way to rectify the alternating current into pulsating direct current. The other was to smooth out the publishmen in the direct current so that it could be used in the B-eircuit of a radio receiver. Every engineer concentrated on these problems, and in the modern type of B-battery eliminator both have been solved almost completely.

The direct current voltage delivered to the binding posts on the B-chmisster depends to a large extent on the rate at which current is drawn from the B-chminator. The more current you draw the lower will be the voltage. In other words, if you have a receiver that draws very little current, the B-chmisster will deliver this current at higher voltage than it would if the set took more current.

Vacuum tubes, however, work best at the voltages recommended by the manufacturers, and if they are overloaded the result will be a short life for the tubes. Your problem is to adjust your B-eliminator so that it will supply the required amount of current at exactly the right voltage. How to do it is depends to a large extent on the receiver you have mid the B-eliminator you buy.

The smaller types of B-battery eliminators that are sold at a relatively low price are usually provided with one adjustment so that you can get the detector voltage set at the proper value. The more expensive styles are fitted with two or more adjustment knobs designed to regulate the voltage delivered to each plus B binding post on the receiver. These adjustment knobs are connected to variable high resistances inside the eliminator case. Turning the knob to increase the resistance lowers the voltage, and cutting down the resistance increases the voltage.

At first glance it would seem that the simplest way to adjust the voltage would



How to Connect Regulator Tubes One can be used with almost my 8-chminator, but only the powerful instruments will work two in section to mountain 100 volta

be to use a voltmeter just as you do with batteries. But that method won't work because the current flowing through the voltmeter causes the reading to be much lower than it becomes the moment you disconnect the meter.

The most practical method will be to determine the proper setting by judging the results. The best way to set the detector B-voltage is to time-in some station that comes in rather weakly or turn down the volume control on a local station until the music is weak. Then increase or decrease the detector voltage until the signal becomes as loud and clear as possible. It is always best to have the voltage net an low as you can consistent with good volume. There is less chance of hum with this setting and owing to the nature of the detector electric aroungement inside the B-eliminator, the lower you can keep this voltage the higher the voltages available on the amplifier circuits.

THERE also is need for care in adjustmg the amplifier voltages, because if you accidentally get them too high, the tubes will be overloaded and paralyzed within a short time. This is particularly true of the radio-frequency amplifier tubes if no C-battery is used on these tubes.

A popular method of controlling the volume of sound on the modern receiver is by means of a rheostat in the filament circuit of the indio-frequency amplifier tubes. Reducing the filament current through one or more of these tubes will cut down the volume without causing distortion.

Deficulty occasionally is experienced with a volume control of this type when

 B-battery channator is used. Assuming that you have set the adjustment knobon the B-eliminator for the proper voltage on the radio-frequency amplifier tubes when they are turned up to get full volume, there will be a sudden instead of a gradual falling off in volume when you turn the volume knob on the set. In other words, the volume control will be too critical. This peculiar effect is don to the fact that the tubes use less B-current with the lower setting of the volume knob, and consequently the voltage on the amplifier tubes rises. Thus higher voltage, in turn, still further reduces the volume with low blament temperatures.

One way to cure this trouble if it bothers you is to add a voltage regulator tube to the circuit. The connection is simple. Place an extra socket insule the receiver calenct if there is room or mount it in a separate box near the eliminator. Connect the grid terminal of the socket to the plus B R P binding post (sometimes marked plus 90) and connect the diagenally opposite filament terminal of the socket to the minus B binding post. Place a UX-874 voltage regulator tube in the seeket and then adjust the knob that controis this voltage until there is a steady glow in the tube when the volume in turned on full. This tube will hold the voltage at 00 regardless of how much or little current is drawn in the circuit within rather wide limits,

The drawing above on this page, shows how to contect up two voltage regulator tubes so that you can get a constant voltage of 180 for operating the new 171 type tube and 90 volts for the other amphifier circuit. This arrangement can be used only on the large and powerful types of B-eliminators, but you can use one regulator tube to advantage across the output of the smaller types of closs nature to hold the total voltage at 90 for use on sets that do not require more than this voltage.

These regulator tubes are particularly useful if you live in a small town where the voltage of the electric light current is not steady

THERE is one other point in the operation of H-eliminators that should be watched carefully. Never turn on the eliminator until after you have turned on the awitch that controls the current to light the vaccium thoses, and always turn off the eliminator before you turn off the set. This procedure avoids placing excessive electrical strains on the large-capacity condensers in the eliminator. If you use voltage regulator tubes, no special precautions of this kind are needed, as the use of these tubes the voltage constant whether the tubes in the receiver are turned on or of.

If You Plan to Buy

A Radio Set for Christmas-

ARE you thinking of presenting a radio outfit to your family as a threatman gift? Or do you con-

template giving a set to a friend? In either case there are important things to consider before you make your purchase.

If your plans are not quite so ambitums and the Christmas money is to be invested in new equipment for your present rano misfal alton, such as a modern foudspeaker, a new storage battery or a B-battery christmator—here, also, are questions to be settled.

Before purchasing any type of complete radio act you must get clearly in mind just what you want in the way of radio entertainment. In other words, you must decide what features are most important to you, and after that you can begin your search for a receiver that will give you the sind of service you want at

the price you can affect to pay. The same considerations, of course, will apply if you are buying a set for someone else.

Your decision will be influenced to a large extent by your location. If you live it New York City, for instance, you will have not use for a receiver designed particularly to bring in distant stations. And this is also true if you live in any of the larger effect where there are a number of broadcasting stations. Whatever knot of set you buy, the local stations always can be received much better than those at distant points.

No matter where you are located, you will want accurate reproduction of music and speech. In fact poor quality of reproduction as enough to condenic any cubo set regardless of any other good points a out the just coner.

In the early days of pulso broadcasting, when all radio sets sounded like five is lar phe-ingraphs, nobody worned about truthful reproduction. The mere winder of hearing voices and music out of the air add everybody spellbound. It was enough if you could understand most of what the apparencer had to say, and amoral selections were disported almost sevoral recognitions. A particular in stance, generally sounded like a cross between a banjo and somebody pounding on a tin wash hotler. A modern radio receiver abould reproduce a piano with sofficient realism to convey the illusion of I ie actual instrument to a person in the next room.

THE number of tubes in a receiver has nothing to do with the tone chality. A five-tube set or even a three-tube set is just as likely to give correct tene intally as a receiver using seven or eight tubes, though the extra tubes may add to selectivity or distance range.

There is just one way for the navice to



Don't stint on accessories, and insist on demonstration — Why the best is cheapest

By ALFRED P. LANE

he agre of getting a radio receiver that has good tone quality, and that as to purchase a late model from one of the reliable manufacturers.

By all means award bargam sales. In almost every case the radar receiver offered in a bargam sale is a discontinued model or the product of none manufacturer who has gone into bankruptcy. In either case you are almost size to get a set that is out of date or deficient in tone quality or some other vital feature. In fact no receiver of any make that was produced more than two years ago can equal in tone quality the better sets that are being made today.

Naturally you will take into account the appearance of your radio receiver You will want it to blend with the other furnishings in the room in which it is to be installed. It will be up to you to decide, therefore, how much you want to pay for fine cabinet work. Most manufacturers

are now turning out their recetvers in various styles of cabinets. If you buy the more expensive models, in most cases you will be spending the extra money for looks, as the exertical units installed in the vorious grades of cabinets generally are of one sougle type.

B ARGAIN sales of radio seta the price includes a complete list of accessories. Often, however, the equipment and with these bargain acts is of very low grade, "Bootleg" vacuum tobes, the born speaker and stale batteries may look all right to the novice radio fun but they give such poor service that they actually prove more costly than good accessories,

It will pay you to lary the best accessored that the market affords. That means high grade, standard vacuum tubes, a modern cone-type leadspeaker, a well-known make of storage battery fresh from the factory, and the larger aixes of dry cell B-hatteries or an up-to-date B-battery channator.

The cone-type loudspeakers are now being made by almost all of the leading manufacturers. Their growing popularity is a clear indication of the quality of present-day radio receivers, for a cone-type speaker will not give good results with a poor quality sel. In fact when cone speakers were first introduced they came in for a lot of upped access supply because they showed up the poor tone qualities of the receivers them in use.

If you want real quality be sure to purchase a receiver designed to use the new type power amplifier tubes. The development of these new tubes is one of the outstanding advances in the radio art during the last year

HEAR the set in actual operation before you pay your money and used on luxing the demonstration made with several different types of loudspeakers so that you can decide which type is most pleasing to your car. In listening, pay particular attention to the low notes.

Eliminators to take the pasce of B-batteries have now been perfected to such a degree that they will give as good results as dry cell or storage B-batteries, and while they cout as much as four or five sets of B-batteries, the operating expense after the B-chiminator is installed in very low. With one of these instruments on the jib, you will not have to worry about run-down or noisy B outteries. In buy uga B-cl maintor, see it demonstrated in actual use on the particular type of radio set it is to operate.

Watch These Points When You Buy a New Set

- 1. Choose a standard make.
- Avoid bargain sales of obsolete sets.
- Insist on a complete demonstration.
- Wake sure of good tone quality.
- Buy high grade accessorates.

Send for the list of radio prerivers and accessories approved by the Popular Science Institute of Standards and use it as a guide in purchasing your new outlit.

Hints for Radio Beginners

A Sharp Drill Saves Labor

How to Improve Cutting Edge What Causes Weak Signals



Cutting Out the "Twang"

Putting rubber pada under the corners of a radio receiver to prevent vibrations from traveling up the table legs and on to the vacuum rubas—a constant cause of trouble

ANY radio fans complain about temble in drilling holes in the composition panels sold for radio use. They say that drills dig m and jam and have a tendency to break through the other side of the panel, leaving a chipped and ngiy-looking hole.

The cause of most of this trouble lies in the fact that ordinary twist drills are designed to cut through steel, and when they are used on a softer material such as bakelite or hard rubber, the angle of the cutting point makes difficulties.

To get best results in drilling these materials, you will find it desirable to stone the two cutting edges as shown in the photograph at the bottom of the page, so that the drill will have what is called a negative rake. In other words, the cutting edge of the drill will be shaped so that it will lose its tendency to dig into the material. A keen-edged drill stoped to a light negative rake will cut through bakelite or hard rubber with an case that will surprise you.

In drilling holes in radio panels, it is best to drill the hole with a small-hameter drill and then follow with a drill of the size denied for the finished hole. Stoning the larger drill is particularly important in a case like this.

You will find that stoping the point of a drill also is advisable in drilling brass. It will climinate the tendency to dig in.

When Signals Recome Weak

BEGINNERS in radio frequently are in doubt whether to blante their tubes or their batteries when the broadcasting becomes weak. Dry ceil batteries of both the A and B type recover some of their strength when left unused for a day or two, whereas tubes that have become exhausted do not show this effect. Consequently, if you find that the radio set sounds almost normal for a few minutes just after you turn it on and then the music gradualty grows weaker, you can be pretty sure that the batteries and not the tubes are to blame.

Weak dry cell batteries should be re-

placed by new ones, but exhausted tubes can often be given a new lease on life by the reactivation process. A reactivated tube may not last as long as would a new tube, but the rejuvenation process generally acids many hours to its life. And if it happens to burn out in the process, you can console yourself with the knowledge that the tube was probably too far gone to be brought back.

Cushion It on Silence Pads

DOES your radio twang like a banjo string every time someone in the house slams a door or walks across the room? Most modern sets are built with cushion type sockets that eliminate this peculiarity. One way to get rid of it, if you have an older type of set, is to place rubber pads under each corner of the cabinet, as shown at the left. Two or three layers of rubber cut from an old inner tube will do the job. Shift your tubes around in the sockets, too, if the twanging is pronounced, because some tubes are more inscriptions than others.

The tube in the detector socket is the one that is responsible for most of the microphonic noises.

Handle Cone Speakers with Care

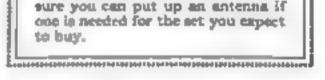
THE code type radio loudspeaker is, relatively speaking, a debeate piece of apparatus. You cannot being it around and expect to get good results. In fact, one fall from the table to the floor is almost sure to rum the paper cone and damage the electrical unit.

However, this does not mean that a cone type loudspeaker needs special handling or is likely to get out of order easily. On the contrary, it may stand up to the hardest kind of work for years.

If you want to get this kind of service out of your new cone speaker, put it where it is not likely to be inpured—on top of a bookcase or near the back of a table that is placed against the wall.

While damp air will not affect its tone qualities, water splashed on it will damage the paper, so keep the speaker, also, where rain cannot reach it.

The amount of mousture in the air does cause the paper to expand and contract, but this expansion and contraction is taken care of, in some makes of cone, by the method of mounting, and in others a thumb nut is used to clamp the wire from the speaker



A B C's of Radio

NO ONE - not even the foremost

results that will be obtained with

any particular type of radio receiver in any given locality. Of course of

your neighbor next door gets good

reception, the chances are that you

can expect equally good results. But if you five in a section where

there are no radio sets, you'll have

can say shout the distance getting

qualities of even the finest radio set

is, "If the reception of distant

stations is possible in your neighbor-

hood, you can depend on this set to

quality of reproduction can be

ecttled definitely. If a receiver gives

a lifelike instation of the real thing

in our locality, it will do the same in

is possible in your neighborhood.

Before you buy a radio set, be sure to learn what kind of reception

If you live in an apartment, make

On the other hand, the question of

All that a conscientious dealer

to take a chance.

get results.

any other place.

radio engineer -can predict the

and to the apex of the cone. Releasing this themb but and tightening it again relieves the strain caused by expension and contraction.

It is describe that the clamp but be loosened and tightened again whenever there is a change in weather conditions. In other words, if the weather becomes damp after a long dry spell, or dry weather follows considerable rain and fog, the expansion or contraction of the paper should be compensated for by this ad-

j istaitent.

Changing the angle of the curring edge of a drill to make it work more quotily and cleanly on such muternals as balcelite, hard cubber, being and so on

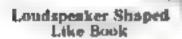
Tune Back and Forth

WHEN you are trying to tune-in an accurately as possible to a certain station, you will find a little stunt used by professional photographers a great help. They always focus a camera by turning the focusing knob back and forth beyond the correct point, less and less each time, until the motion finally stops at exactly the right point.

Applied to radio, this means that you must move the dual or control back and forth until your ear tells just where to stop.

A vermer dial will prove a help in fine tuning. Radio in New Forms

POPULAR SCIENCE MONTHLY



In appearance this new type laudapeaker shows (bustom view at eight make just like a large book opened and supported at the curvert angle for reading. The effectival unit is convenied underseath the curving displaying of heavy paper "pages"



The Chicago, Milwaukee and H. Paul Radway is completing the installation of a short wave eadin system that will serve for the reliable dispatching of trains during emergencies such as torundoes, landslides, weathouts and other duranters that interrupt train-dispatching service over telephone and telegraph wires. Walter Discuss, of the company, is shown shows that had it

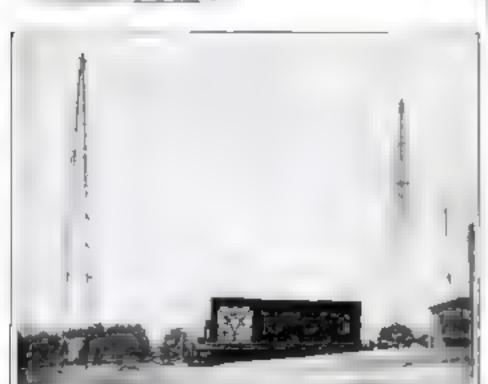


Illuminated Control

Left: The refluioid dial and all the mechanism ore mounted book of the panel with a opicial benef feature for into the panel in the poasson disserved. The top button turns on a small electric bulb behald the dial



A unique feature of the latest French airplane cacho art in the voltage control of the generator. No matter what the speed of the plane through the air the springs controlling the propeller in shown in photon at right adjust it to turn the generator at constant spred



Broadcast Studio Looks Like Radio Receiver

Station WPAP at Paliedes, N. J. has built a studio, above, modeled after a radio reverser. Round windows represent the dash. The loudspeaker opening can be seen at one and of the building.



Attachment Connects Phonograph to Radio Set

The plug shows in the illustration above is substituted for the detector tube in the radio set, and volume is controlled by turning the control unit knob. No sates betteries are needed

What's Wrong with Spratt's Car?

See If You Can Figure Out What Happened-Here's a Chance to Test Your Auto Knowledge and Win a Prize

ENRY SPRATT pggled the spack lever up and down in a vain effort to make the top of the full on high. "We shought I have to shift into second on a grade like that the granified as he pulled aver to the side of the road and stopped I ie car.

I told you you were crazy to buy a

secondhand car and start right out on a long tour with p 'replied Mrs. Spratt. "You might know something would luppen "

Henry untangled his long frame from beneath the steering wheel. 'Don't start crabbing so soon, he said. "I know what's the matter now. The spark is no good because the contact breaker points need rleaning. Just watch me and you'll see how the job ought to be done

I hope you're right. Henry," sighed Mrs. Spratt. "Is that what's been making the engage most so much? I thought when the engine intend it was always the spark plags needed eleming. You told me that yourself

"It depends on law it misses," Henry asserted lafuly, "If the most is regular and losepa time with the revolutions of the engine, it's always a spark plug, but if it skips at raudom you can't blame any one spark plug. There s only one pair of points that make contact for all the

eylanders, and if they get rough the motor is likely to mess in any exhaper.

"QEE, here's the trouble. I was right. The current has borned a hole in the stationary contact and all the nictal out of the hole has piled up in a cone-shaped point on the other contact.

"What are you going to do about it?" questioned Mrs. Spratt. "You certainly can't cut off that point and put it back in

the hole where it belongs."
"Certainly not." Henry admitted. "But I can use this file to get rid of the hump on one contact, and I can file off enough of the other to get it smooth and flat again. The secret of this job is to get each contact rounded just a trifle so that when the two come together they if touch in the middle arstean of at the edge.

Henry proved he was right, for now the motor can without a skep. They burning along at good speed for several miles.

"My goodness" exclaimed Mrs. Spratt. "My feet are burning up. Are you sare the motor isn't on fire, Henry?

"It is kind of warm," agreed Henry "I'll stop and see what's the matter." As soon as the car came to a standstill a gentle basing nouse because and tile and wisps of steam floated up from underneath the radiator. Henry shut the motor off.

"The fan belt seems to be all right and the radiator isn't leaking anywhere," he

Can You Help Him Find the Trouble?

I'M STUMPED," said Henry Spratt despeiringly, as he gazed at the motor of his stalled car under the feeble rays of the

Can you help him out? Read the accompanying story through to the end, then write to us telling just what you would do in similar circumstances. There's a prise of \$25 for the best letter.

> observed, puzzled. "I know there's plents of water in the radiator. Ab" Here's the trouble! Look at that upper hose connection. See how the robber is all swelled out? It's getting rotten and Ill but the made layers of rubber have swelled too, and closed up the passage. I il draw the radiator far enough to get the water level below where that burg hose is. Then I can take off the hose connection and cut out the extra rubber.

> tgain Henry proved he was right. He usade the repair quickly.

> "I hope nothing else happens," said Mrs. Spratt a bit more hopefully

"Knock on wood and trust in me." Henry suggested. "I'll keep the old hus running unless the wheels fall off or-Confound it! She's missing again! Now what's the trouble? Acts like the maxture is too Huck."

"Oh. dear" wailed Mrs. Spratt. "You will never get it fixed now. It's as dark as

Humph" growled Henry. "Don't you think I can set the earhuretor in the dark? Just watch me!"

Henry soon had the bood up. As soon as he burned the knob to cut down the gas supply the id ing motor picked up-speed and run quite steadily. "There you are! All set again," he said as he settled his long frame behind the steering wheel.

The car ran fairs, well for several raties and then on a steep half the motor refused

> to pull except in first speed. In fact they barely made the top of the full even it

> THE missing, and weak, toneven retring beening more pronounced until finally the motor quat firing completely and the car polled to a standstid

> "Id du tatopat." suggest Henry previous in answer to the unspoken question in less the keyes, " Poust. naturally died. Something mest be wrong with the curbaretor. The gasoline is dropping out of it to heat the band. That means the float is on the blink or dark has panimed the float valve.

> "There!" he exclusived, after he had taken off the float bowl. "What dol I ted you? Look at all the dot in the bottom of the bear Merit's element out it ought to run as fine as

> Henry was doomed to disapporational, however, for although the motor started, it promptly stopped again to the accompani-

ment of a gurging, stranging noise, A. second later gaseline started to flow out of the lower air utake of Lie carmirctor in a sleenin,

He grouned, grabbed a weench and attacked the earbureter again. The second cleaning did no more good than

"I m stramped" said Henry despairingly as he rested his elbows on the front fender and gased at the motor under the feel le mys of the temble light.

What Would You Do?

Porchar Science Mostrix will pay \$25.00. for the best letter explaining the nature of the trouble with Henry Spealt's car and telling him how to accreame his difficulties. Your letter will be judged solely on how accurately you give up the trouble and suggest the remedy. Medakes in grammar or punchation. do not count. Address your letter: Automobile Editor, Popular Science Monthly, 250 Fourth Assaue, New York City, All letters must be received before January 15th, 1927.



TS an even break in thrills when Father buys the Boy a Conn for Christmas!

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Seven Useful Ideas for Your Car

Extra Wheels Save Chains When Driving on Snowy Roads

THILE many motorists seem willing to take a chance on driving without chains on wet roads, mich protection is absolutely indispensable in the winter when the roads are covered with deep anow,

Snow, however, often covers the road only in spots, and the chains wear rapidly when you strike the bare road surface,

A most ingenious way to get around this difficulty is to fit an extra wheel to each of your regular rear wheels, as shown in Fig. 4. Four wooden blocks are bolted to the spokes, and the extra wheel is mounted on these blocks. The diameter of the extra wheel should be enough smaller than the wheel to which it is bulted so that the chain will not touch the ground when you strike surface that is not covered with snow,

This arrangement has still another advantage in that the wide tread presented by the double wheel effect keeps the car from sinking into the snow.

Wooden Wedge Supports Spring

WHEN It becomes necessary to replace the ordinary type of rear spring shackle holts or bushings, you will

find a wooden wedge extremely undul (Fig. 8). It should be made of hard wood, as wide as possible without sticking against the sides, and the wedge should be

When you want to remove the bolts, drive the wedge in place just tight enough to take the weight off the bolts. It is unnecessary to jack up the frame of the car.

Rubber Band Stops Chating

DLAT tires are often caused by the I chading of the tube against rough or rusty spots on the rim between the bends. of the shoe. A regular fabric flap is sold to climinate this trouble. If you have no flap, a good substitute is to cut a strip from an old unter take and place it as abown below in Fig. 6. If you cut a piece out of the band and cement the ends logether, the spring of the rubber will hold the band in place. Bewing the ends of the band bolds the joint tight.



Fig. 6. A rubber band cut from an old must tube prevents chafing

It Holds the Flashlight

BLOCK

BOLTS TO BE

Fig. 3. Use a bard-

wood wedge like the

one shows above when

you change spring

shackle bolts. It will

seve jeching up frame

REMOVED

REPAIRING or changing auto tires at night is a nussance unless you can arrange to have sufficient light to see what you are doing. A standard



Fig. 1 A good dashlight at the correct height on a wire stand of this type will take much of the discomfort out of tire changes at night



Fig. 2. Equip your valve turner with a cup of this type and avoid spilling oll on floor. Be sure that it turns freely



Fig. 4. An extra wheel bolted on in this way will prove unrial in heavy snow and anve unnecessary wear on the tire clustes.

type of flashlight will give enough light, but if you are alone in the curit is inconvenient to have to liold the light and work at the same time.

One way out of the deficulty is to bend up a simple were stand as abown above in

Ten Dollars for an Idea!

ROSS H. ARNETT, of Medina, W. Y., when the \$10 prime this month for his suggestion of extra wheels to mye chains in winter driving (Fig. 4). Each month Popular Science Montany awards \$10 m addition to regular space rates to the reader sending in the best idea for motorists. Other published contributions will be paid for at usual rates.

Fig. 1, to hold the flashlight. Any piece of heavy wire will do. A loop bent as shown serves as a sufficiently firm base, and the upper end of the wire can be formed into a cradle for the flashlight.

Cup Catches Oil Dripping from Petcock

O's CARS fitted with small petcocks to determine the level of the oil in the grank case, oil is bound to be spilled on the floor of the garage when the oil level test is made. A way to eliminate this trouble is suggested in Fig. 2.

Long-handled keys for these petcocks can be obtained in almost any auto suppry store, and a small metal cap is riveted to a piece of thin strap from that is bent as indicated.

The hole through the bent from should he large enough to allow the cup to turn easily and consequently remain underneath the petcock as the latter is turned.

Jeweler's Saw Sayes Time

IT MAY frequently happen that a turn-backle used to adjust the length of a brake rod on your automobile is turned so for that the ends of the rods are brought

JEWELER'S

ROD ENDS

TOGETHER

Fig. 5. A jeweler a new

wi's anve tripe when a

turnbuckle has reached

the end of the ad not

son entity out through

all morts of brake rods

These blades

ELOSE

against each other, preventing any further tightening.

It is possible, of course, to turn the turnbuckle harkward until the rod ends are released, and then saw off a piece of each rod with an ordinary lucksaw. But a much sampler way is to use a jeweler's saw, as demonstrated in Fig. 5. and cut off the rods without disturbing the

adjustment. The blade is tightened after it is passed through the opening in the turnbuckle.

A Running-Board Ice Carrier

THE most convenient place to carry a large chunk of ice in an automobite is, of course, on the running board, but if you have ever tried it you know it is rather a difficult job to strap the ice in place satisfactorily.

A few special study mounted on the runtung hoard will solve the problem. As shown in Fig. 7, they are made of 12-mile carriage bolts with a hole drilled in the bolt to accommodate a 14meh put. When not in use the pins can be lifted out of the holes in the bolts and then stowed away in the automobile

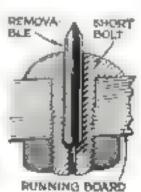


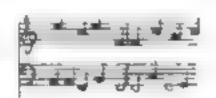
Fig. 7. Stude like these will make it easy to carry see on the running board

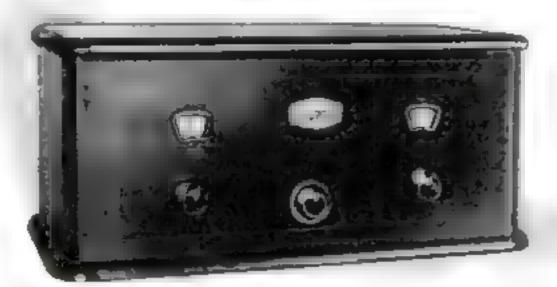


7ITH the FERGUSON Model Twelve you enjoy absolute fidelity of tone. The rendition in the distant studio reaches your living room round, full, clear-with all of the original expression of the artists. When an orchestra plays, you hear all of the notes both treble and bass - the harmony of the whole. The music rests and soothes you - as it should -because the true tone colors; all of the countless delicate shadings and overtones; reach you unaltered -in perfect timbre!

The nearest Authorized FERGUSON Dealer will be glad to let you hear how enjoyable radio can be.

J. B. FERGUSON, INC., 225 West 57th St., New York, N.Y.





Model Twelve - a precision-built 6-tube FFRGUSON, with superb cabinet of graceful lines, \$75. (Ten per cent higher West of the Rockies.)

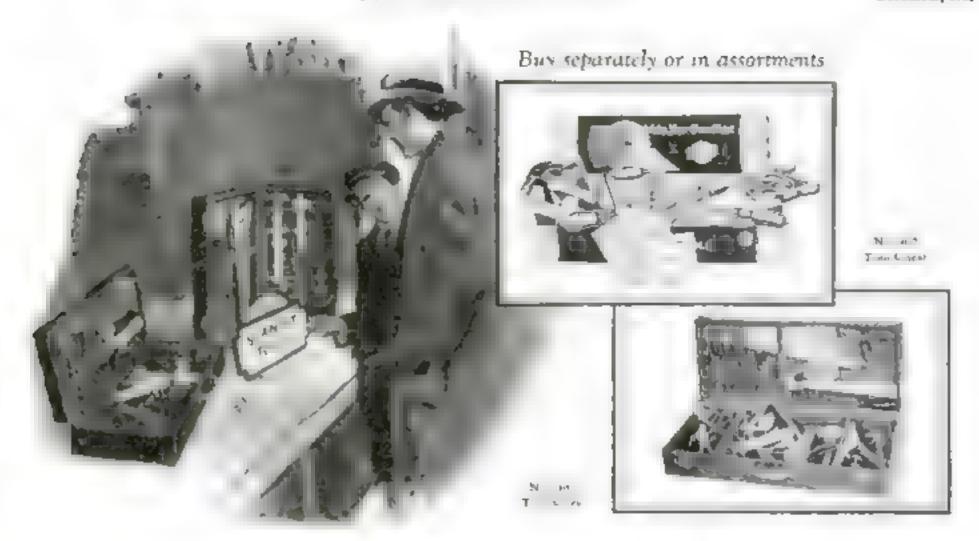


The Two Tuning Diala Light when the Receiver is in operation.



Complete shielding giors this Receiver ers Marked Selecdaugety.

No Sensonal Models— Continually Developing Refinements



A Christmas tip from the carpenter

LOOK at any fine piece of carpentry work. The finish comes largely from the skill of the carpenter, of course. But there's something else. Look into his kit. You'll see not only an adequate number of tools, but find them all fine tools, many carrying the Stanley name.

Right there is a Christmas tip from the carpenter—a chest of Stanley Tools this year for some man or boy! A fine assortment of tools, and all good tools the right set for repair work or the making of such things as book cases, dog houses, and other useful articles. The sturdy oak chest keeps the tools safe and handy. A Stanley Tool Chest is a complete gift.

You will find Stanley Tool sets at a wide range of prices and in a wide variety of assortments—from No. 904 with 12 tools in a fine oak chest at \$15, to No. 850 with 49 tools in a beautiful cabinet at \$95.

There are also assortments of the same Stanley Tools in cardboard display boxes with simple directions from which the recipient can make his own chest. There are several of these "Make Your Own Chest" assortments, at prices from \$5 to \$20.

There's a Stanley Tool Set to fit every pocket-book!

Ask your hardware dealer to show you the line of Stanley Tools. And send for our Catalogue No. 34-E which describes Stanley Tools both separately and in assortments. Address: The Stanley Works, New Britain, Conn.

The best tooks are the cheapest to use Ask your hardware dealer

6

STANLEY TOOLS



How to Make Fascinating Toy

Birds and Animals for Christmas

By F. CLARKE HIGHES

TOY making is not difficult. It may be done quite as well by women and girls as by men and boys. In fact, very few of those who have never attempted the work realize how simple it is to construct attentive toys toys that will give keen and fasting delight to the children who receive them on Christians Day

About the only equipment meessars for making many little test such as are to be seen in gody determined shop wardows at this season of the year are a coping (fret or bracket saw, a jacksmie, a baragier and a cule.

While other tools are sometimes herded and are always useful they are not essential. Do not, therefore, let the lack of tools or a beach prevent you from beginning.

Once you have follow under the fascination of the work and discovered what for there is in mak-

ing tave, you will delight in adding new tools to your kit and in a short lime you will have a house workshop equipped for much more ambitious undertakings. That a the joy of working with tools, you always have something to look forward to something new to make some new process to learn, some new materials to experiment with, some new tools to long

The subject of tools cannot be dismissed without mentioning a latter. Indeed, for many of the spendle toys so much in vigue these days, a wood turning lathers the thing to use. Those who be-



We'll-designed wooden sulmal toys are more popular today than ever and making them in great flux

come thoroughly interested in toy making will want to have a lathe somer or later, but us the beginning it is usually possible to devise a substitute tool process or change the design of the toy so that turning is not required.

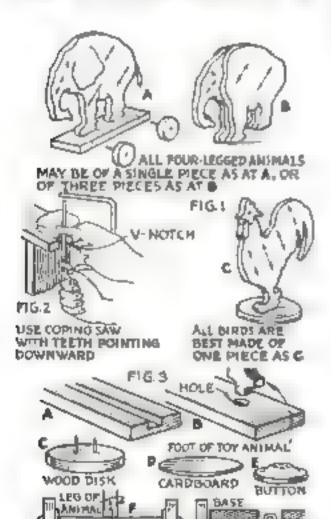
In cutting out practically all of the toxicallustrated in this actuals an ordinary coping saw is sufficient. These saws may be purchased at hardware stores and are among the most inexpensive of tools. A supply of exten coping saw blades should be obtained. They, too, are chemp, so that the breaking of them, which is bound to happen now and then, is a small matter.

The correct method of tang a coping saw is illustrated in Fig. 2. Boards as heavy as I in. in thickness, if of white pine, has wood or any noft wood, may be sawed quite easily in this way

In Fig. 9 (page 101) are shown a number of animal forms that were drawn especially for wooden toys. These may be enlarged and used as patterns for toys of many types and mass.

DECIDE first to what size you wish to enlarge the toy. Draw on a piece of stoff paper or thin cardboard the same number of squares as appear over the out line you entend to copy, but make the squares proportionately larger. In each square draw whatever appears on the corresponding but much smaller square in Fig. 9, so that you will obtain an exact enlargement of the original drawing.

"What a lot of drawing to do!" you may say Well then, don't do it Send for Home Workshop Bineprot No. 56, using the compon on page 102. It contains every one of the designs in Fig. 9 drawn full size, ready for tracing directly on the wood. The elephant, for instaine, is 7 is no, long over all and 5 is in, high, the pelican is 7 in, long and 5 is in, high the pappy dog is 4 is by 5 in, and the others are of the outward on page 18.

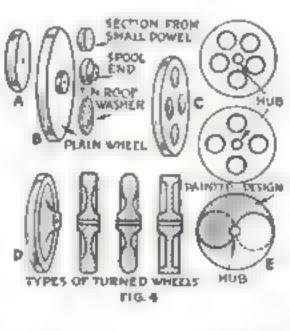


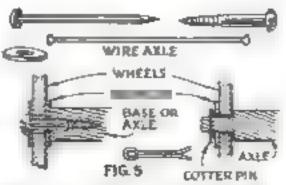
One and three piece toys and several types of bases, how to cut forces with a coping saw

BLOCK

WIDTH EQUALS

HALF OF HE GHT





Wheel construction at a glance various haby decorations, and methods of mounting

Brush Lacquer and Your Car

How a Brilliant, Durable Finish Can Be Given Any Automobile

By RALPH G. WARING

"Al,L ready to start lacquering the car, Dan?"

"Then get an inch and a half litch brush, and a three-arch brush, as well

I'll meet you in the garage

First I asked Dan to sprokle the floor with the watering can. Although he quees do not absorb dust as read by as vacaish and enamel, this presention is worth wirle. Next we washed the brushes eight with lacquer the next.

The lacturer was stirred thoroughly for about five min ites to assure a perfect blend of nignient and because body

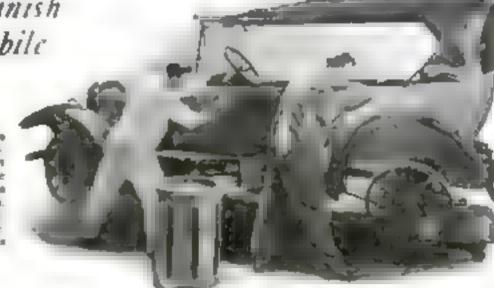
I sing the smaker of the brushes, I showed Dan how to cut across the top of the door, working from left and right towards the center of the roll edge with a fully loaded brush. This left a plump surface, it was brushed just enough to present larving the lacquer sag

A newspaper was poshed quekly into pance between the skirt of the body and the classic frame to eatch dries from the S-in brust, which was used to flow the brusaing lacquer across the panel, working as on the rol. The lower edge of the last brush stroke was always wet and heavy enough to flow into the lop of the

next stroke

Dan and I found that it required conpiderable judgment to determine just when to stop brushing and just how much nucleral the brush should carry without having a sag. Lock wise with its. Except for one small sag in the lower corner of the door, the surface looked for.

"We won't worry shout that. I consoled Dan, "for when it has dried, we can cut it out with water sandpaper, We'll make haste slowly, however, and The lacquer was rubbed to a glass like surface first or its very fine study and a mild soap solution. then with a mill ture of purious whiting and such



gain a little experience in our brush work as we go along.

"Let's do the cowl next. I shall start bere on the lower right side, brush in this panel complete, cross over the cowl with strokes parallel to the windsheld and work only from the unfinished part to the fresh inequered work, all with a rather abort stroke

WHEN it came to the rear of the body, I started on the right sofe next to the rear doorframe, and brushed in lines pandlel to the feaster, keeping the fresh work newny and nev right unto I had advanced mut the shoulder, then I bound it was ensest to take a stroke of from 4 to 6 m. long, moving quickly from left. to right, and a similar stroke one brush width lower down. The strokes faded out narekly where they met on the freshly. inequered shoulder. In this way I was able to flow out the lacquer just as I had on the door and a smooth job was the result. It seemed that the lacquer set too quickly to take a chance on mong an up and down stroke,

"Now, Dan, let's set the hood over on this low nawhorse," was my next suggestion. "That's right, turn it so that the ventilating slats on the side have the edges pointing down. The face of the hood we set that country, it the time of the hood we far as the right of the set lated many can best be worked with the inch and a half brush. Notice I start the stroke from the end of the slit toward the center, working from both left and right, thereby avoiding the possiblity of a sag at the corner.

This done Dan went ahead with the black work on the feeders and f did the many little odd jobs of touching up around the windshield and radiator.

frame, lamps and elsewhere,

We gave the lacquee a five-hour drying period before applying the second coat. We found that this coat look hold of the first just enough to make the brushing a little harder, but not enough to be really troublesome. I make variash and enamel, lacqueer does not require to be sandied between coats. That is because lacquer coats dissolve one another partially and so bond perfectly.

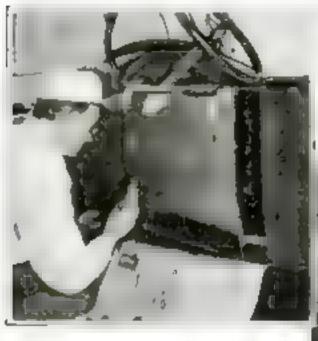
"We'll let this last cost dry overnight." I told Dan—it was late anyway—"and then we'll come here the first thing in the morning to water-sand and polish the ear. You remember that in the experimental work the largoer moded better with a neutral scap solution in place of clear water, so I want you to cut up a small size bar of waitr scap and put the claps in a gailon pay full of cold water. In the morning it will be ready."

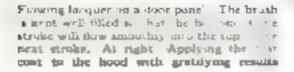
DAN was wait in for me at the garage the next morning with his usual sinde. He was inspecting critically the work we had done.

It a pretty good in that eggshell finish, just as it is, he remarked.

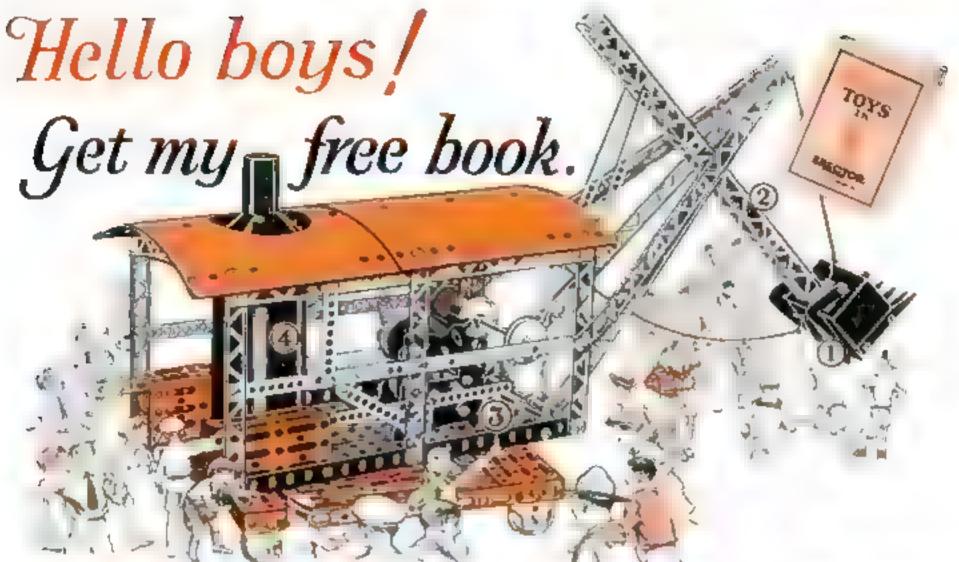
Nevertheless, it will be a lot handsomer if we sweat over it for a few hours,"
I assured him. "Pour out some of that
wap solution into one of the shallow pain,
and mix one third whiting with two thirds
FF pumper stone to a supply paste. Tear
up a bunch of sm-0 sandpaper of the wetor-dry type into eighth sheets and then
we will go to it. Have a pail of the soap
solution handy to dip the paper in and
another pail of clean water, with a
chamers and a sponge

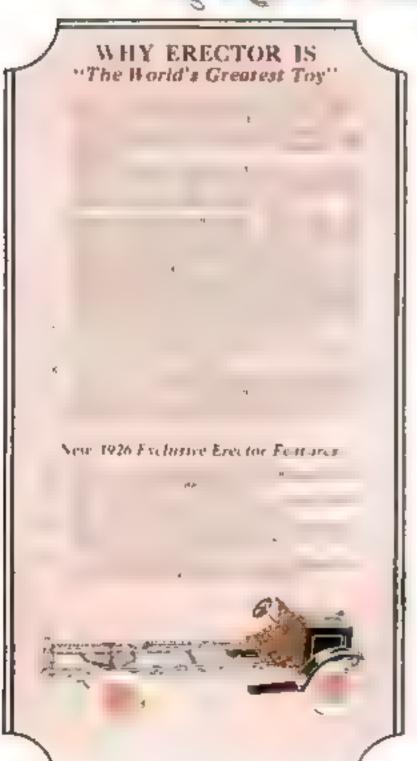
I demonstrated just how to hold the piece of sundpaper with one corner enight between the thumb and first fuger, and the diagonally opposite corner between the little finger (fundament on page 97)











It tells you how to build steam shovels, dredges, automobiles, aeropianes, engines—1000 work-ing models, many in colors, all from one marvelous construction set.

Just think of the fun that is waiting for you when she rime about the scharvelous working models of the greatest regime? said a strains, draw-or-tges, scharp sheeds, concrete mixers, light mesons, gives, mesons, is knows, railroad signals. And when you actually own a new Prector bet you'll get the thrill of your life when the motor starts to pair and the model which you have built with your own hands starts working "Oh, boy! how you will shout,

Christons or any other time will be the best day of your life when the get your Erector. The box is jammed full of fun. When you bit he is and see all the wonderful parts, some at colors, your hands will a late start building models right away. You'll play with Levetor residually be playing with Erector a year from now, we.

But send for my book that very day. Then you can show Dad the pictures of these dandy Erector models. He will understand why boys call the new Erector, the world's greatest toy.

The Super Erector No. 7 The Set that Builds the Steam Shovel

This most popular Exector Set. This is the less a to contain the famous new Exector digger part, so that you can build the Steam Shovel illustrated above. Contains powerful Exector electric motor which makes your model our new Exector boiler for building engines; also have plates, curved girders, perforated strips, die resegons la veled gerrs and brans gears—473 parts, some in colors, channeled and lectrically baked; builds 533 models shown in 76-page name. Packed in a variabled, hard-wood box. Tell Dad now that this Exector Set and make you happier than any other present.

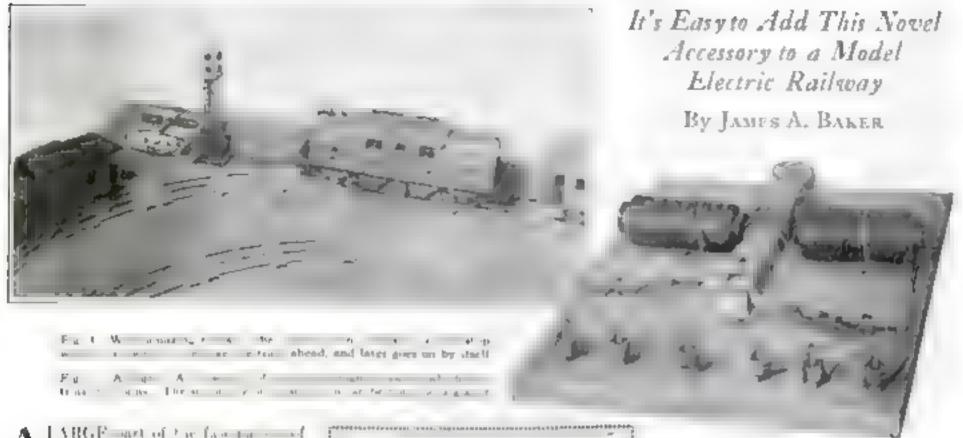
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An Automatic Block Signal System



A NRGE mart of the factors and prodel electric radways lies in oper ating them in as remotic a manner as possible. The numerous factory built accessories are a great help in obtaining this effect. Crossing gates that close and open as the trian goes by, awtches electrically controlled by builtons, and count less other details can be added piece by piece, until you have a marvetonsly complets system.

Yet in spite of the amount of apparatus available, it is still impossible to buy a real automatic block aignal system—one that actually will control the operation of two transit evinous on the same track and prevent a rearrend collision if one of the trains happens to be traveling at a

greater speed than the other

You can buy a thermostatically controlled train signal that will stop a single train for a few seconds and then allow it to proceed as the aignal lights change from red to green, but this device will not stop a following train and prevent a codision. For the model milway owner who has only one locomotive it is nationally, but if you have two locomotives something more is needed.

WHAT you want is a real natomatic block signal system and the construction of such a device is extremely misple. In fact the control device shown in the illustrations on this page was put together in one afternoon with no tools to work with other than a small wood saw, a pair of wire-cutting phers, a guidet, a seriew driver and a soldering iron. And the soldering iron was not really no essary.

The wring that completed the notallation also was finished the same aftermon and after proper adjustment, the block signal system worked without a single fails refor over six months until an exceptionally bad spell of damp weather.

last sommer caused the wooden arm to swell and necessitated a touch of the screw driver to loosen up the friction on the arm.

It is still in operation,

Can You Work This Out?

HERE'S a little problem for you the automatic black signal system described in the autompanying acticle is introded for trains running only in one direction. Can you make a several diagram to shore how the system may be connected up by means of electric problems as that it will work no matter in which direction the teams travel? Send in your solution before December 31 1996. The hest solutions will be published and paid for at the rate of \$5 mech.

and those who have watched it work have marveled at the sight of two trains running continuously around and around on the name track with no attention. When the faster train creeps up too close behind the other it is stopped in the block until the front train regains its lead. To the observer it is so rea, stortlast it idenost seems as if there must be a to v engineer in the cab with his band on the throttle.

The heart of the automatic block signal aystem in the electromagnetic switch shown in Fig. 2. It has been made just as simple as possible so that you can build it with the tools found on almost

prove the crude appearance and workmanship as much as time and facilities will permit as long as the basic principle is not changed.

No alteration is necessary in the design

every home workbeach. You can im-

No alteration is necessary in the design or construction to allow for different types of current supply or voltage. It has been tested on both alternating and direct current at voltages from 6 to 21 and 1, works perfectly without even a change in the friction adjustment. That means, of course, that you can use it on any of the miniature electric train systems sold today.

The electromagnetic matrix consists, essentially, of two electric magneta placed on opposite sides of a movable moden arm. On the arm are mounted metal contacts arranged to touch other contacts fastened to the wooden base,

Fig. 3 shows a wiring diagram of the complete installation, which consists of the electromagnetic switch idestrated in Fig. 2 a signal tower for the red and green lights (Fig. 1), and the two track contacts A and B (Figs. 3 and 4).

Current is sent through the windings of the magnets by way of the contacts A and B, which are placed between the cash so that the collector rollers on the electric locomotive will bridge the gap between the third rail and either A or B.

THE first job is the construction of the electromagnetic switch. Study Figs. 2 and 5 very carefully before you start work. The base is made of a piece of board approximately 1/2 by 6 by 7 in. It would be possible, of course, to make the whole control on a base measuring less than 2 by 8 m., but that would require extremely careful workmanship and there really is no need for a small switch as this unit can (toutoned on page 100).

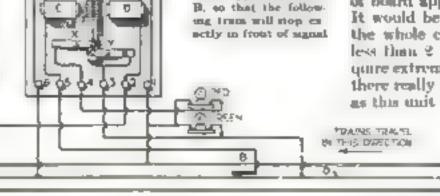
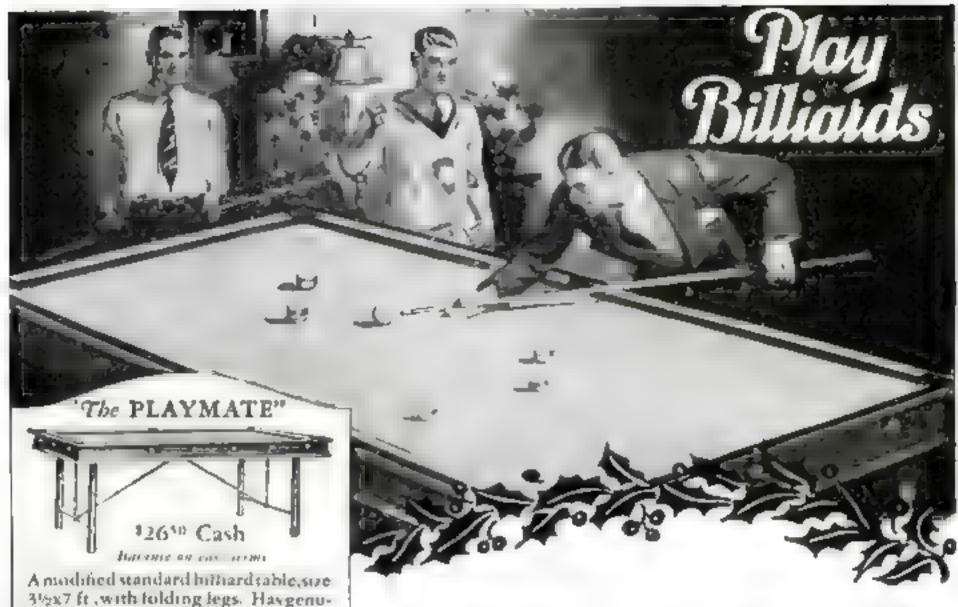


Fig. 1. The lights are

mounted in a agnal

teack opposite resident

Turn to page 74 for the continuation of the Home Workshop Department.



Make This Christmas The Best Ever

Have Dad Give You a Brunswick Home Billiard Table

TO game will provide more genuine pleasure, more fascinating entertainment, more lasting enjoyment than a Home Billiard table. It is the greatest gift of all - and lasts for years and

me slate hed and all playing qualities.

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plete with full playing equipment At a slight additional cost interchangeable cushions may be had making it available for either carom

Smile are rights. The proches he recent waite

lip distal in the way on the an

or pocket billiards.

Right now is the time—of all times

Brunswick Home Billiard Tables Are Inexpensive

A small initial deposit brings one to your home in time for Christmas. The balance may be paid as you play. No extra space or special room is peeded for the newest Brunswick Home Table

—to obtain one. For billiards is a sport that you and everyone you know can play and enjoy. And the more you play it the more interesting it becomes. It is splendid exercise, does you good both physically and mentally. Develops judgment, clear thinking and coolness

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THE BUUNSWICK-BALKE-COLLENDER COMPANY Dept. H 1.63, 623 S. Wabash Avenue, Chicago, I. Gentlemen. Please send the complete coscriptions of your house b. are tables a galaxy with prices and terms, and objige dadress

Better Shop Methods How Expert Mechanics Save Time and Labor

Machine Keys-How to Fit Them

Straight, Tapered and Woodruff Types—Ways to Remove Them If Badly Stuck The Time-Saving Kinks of Old Bill

By JOE V. ROMIG



Fitting a feather key. To do a coally good job always case for more han general experience and everage care

ACHINE keysenopte together our shafts grave and pulleys, barnessing our greatest servant, power. The standard shapes and kinds of keys are well-known to most mechanics, but many interesting points sometimes are overlooked in regard to them. Keys are fitted into inflet or slutted grooves in the two parts to be fasteness together, they may have plane or gib head ends, and toey may be straight or tapered. Simple choogh, it strue, yet to be able to fit any one of them properly has always been a test of mechanical skill.

When driven lightly home, a correctly sented key that is large enough to drive its load will also hold the gene or policy in pince on the shaft and prevent its slipping.

A straight key generally is used in connection with one or more set screws and needs only to be a light tapping fit on each sole, because these two faces are in frictional contact with the keyways. This type of key allows pulleys and genes to be disassembled with ease. Plain taper keys are fitted so as to have a light driving contact on both soles and a perfect fit on top and bottom.

WHEN a taper key is to be used in an inside position on a shaft, it is obvious that the key way in the shaft must be cut twice the length of the key so that the key can be driven home from one side or the other of the pulley or gear. If the key is to be straight in this construction, it can be made to slide with a light frictional contact on the sides and, after it is in position, it

can be held firmly with set screws. When the palley or gene is close to a shoulder it or not advisable to use a taper key unless there is room for a head on the outside. Otherwise it would be very difficult to withdraw the key after it had been driven hard into its scat. Seldom can any provision be made in the design for withdrawing a taper key in this position other than using the gib key, but it is not always possible to use this type of head.

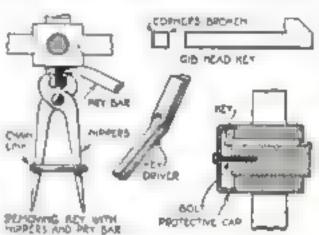
Gib keys are generally used in end positions on shafts. Keys that must be driven tightly on

account of unusually heavy loads should be preferably gib keys, as the head provides a means of withdrawing them more easily when repairs have to be made

Where a taper key must be driven hard, it is good practice to give the ends a generous bevel and the fit should be emphasized on top and bottom rather than on the sides.

The standard taper for keys to by an a foot; in practice, however it is not always possible to both this taper true. Any variation from the standard may be compensated for by fitting the key to the taper which has been cut in the pulicy or

gear. In doing this, both ends of the keyware are cathoried at a the Cop of the key pinned or filed down to correspond Another good way to to make a dominy key either of sead or hard wood. When the dimins is cut down somewhere near the right size, it may be driven into the key seat and driven out again. It will then serve as a money for making the key



Oth key, key driver or drift, a safety cover and a setudia inty method of removing a key

In former years it was customary to forge gob keys or shape them out of rectangular stock, but now the commercial keys are so much the proper axe that a few monotes' work with the file half that is necessary in fitting them.

Commercial keys may be obtained in rough for firshed wass. The rough keys are usually from \$\psi\$ to \$\psi\$ in oversize and are intended to be bushed by hand. These come in handy for making up special keys or fitting one where the keyway has been worn or cut larger than standard. Finished keys requires little fitting if the keyway has been corefully cut.

When fitting a key a la meant should be used. A triltaic is also necessary to aid in indicating exactly where the key is bearing in its sext. To serve this double purpose, white lead mixed with machine or land oil is excellent. The maxture should be about the consistency of thick cream. (Continued on page 12),



Removing a key with a drift. It is well known by all much mats how troublesome a stubborn key can become

MANY time-saving shop ideas are contained in the continuation of the Better Shop Methods Department, on pages 119 to 128.



"Where's your combination square?"

Any man that's ever worked with a Starrett Combination Square can't see how it's possible for anybody else to try to get along without one.

And they are—those No. 94's—just about the most useful tool in the chest. They replace seven separate tools—square, miter, height, depth and marking gages, rule, level and plumb—and they'll do the work of each just a hair better than the original tool would do it.

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Starrett No. 94 Combination Square

276

Use Starrett Tools



OR the mechanic and for general home use, the Pexto Samson Ratchet Bit Brace, illustrated above, will give a lifetime of dependable service and stand up under the severest "roughing." Its ballbearing chuck gives the Pexto Brace a grip that never lets go. it will hold round, square or taper-shank drills. The Samson is the kind for you—it's a boon to the "home mechanic."

PEXTO TOOLS are carried by practically all progressive dealers Write for Booklet

The Peck, Stow & Wilcox Co. Southington, Conn., U. S. A.





When there are children to the family a popular Christman table renterprece is one representing Santa Claus and his reinderes

How to Decorate for Christmas

Brilliant Window Effects Lighting the Lawn -Doorways and Stairs -A Table Centerpiece

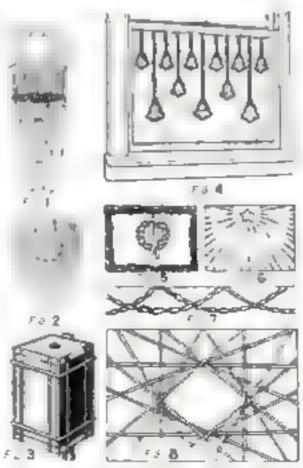
By CHARLES M. MILLER

THRISTMAS decorations of the need original appropriate and interesting kind are not those bought ready-made in the rush and hurry of last-monute shopping, but those prepured in the home with the merry cooperation of every member of the family

VI sorts of ideas can be worked out, at ample or elaborate as you please. In no case is it likely that every one of the maggestions to follow will be carried out in the same home the same year. An effort should be made, however, to debeen customary in previous veges

and doorways, open stairs as and last but not least, the drong tuble.

velop the decorations a list more than has The home decoration may be subdivoted as follows: lawn, porch, windows, Christmas tree, light og fixtores, areles



December the purch light, a from lapters, and various methods of consumerating windows

Starting with the newer feature of holetime recognition let the law robe dluminated at night during Christinus week. If an evergreen tree is growing there, an electric cord can be run from the nearest weeket and two or three strongs of lights bring on the houghs. A breaker or flasher userted in each of the strings adds to the effect, especially if the strongs cross and perposa,

On other trees hang red lanterns. These may be lighted by electrosty or with candles. Homemade lanterus are more appropriate than Oriental. The use of eartons for huterns simplifies the problem. They should not be large, not over 8 in. to a side

Cut opening designs in the sides of the boxes and paste rost paper over the entire outside of the lacters. Crepe paper is best, as the color is stronger and yet softer in effect, but it should not be

Another idea is a box lantern (Fig. 3). attached to a stake driven into the ground, if it isn't frozen top hard. A light framework with a wooden top and bottom is satisfactory

THE porch decorations may include some of the lawn features, but free tooned atreamers are, perhaps, more filting. An overhead porch light may be melosed in such a way that all but the downward rays are cut off. Below this bousing drop a great many loops of narrow, bright colored strips of paper and some silver and gift strips as well to give an effect similar to that in either Fig. 1 or Fig. 2. Gloss coated, colored papers such as are used for boxes are good for this, but narrow strips of crèpe paper are more transparent

Thriling effects in rolor are possible for there is snow on the ground. Three or more colored spotlights may be improvised and thrown so as to mingle the different colors on the white surface.

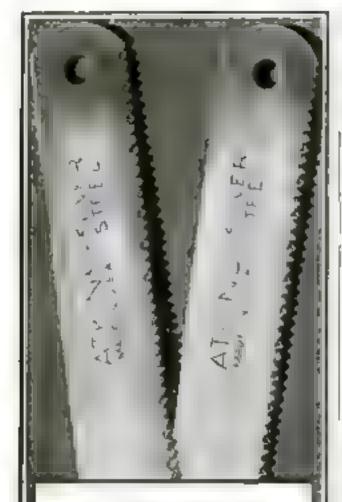
Window decorations may have many motifs. The sil-Continued on page 76)



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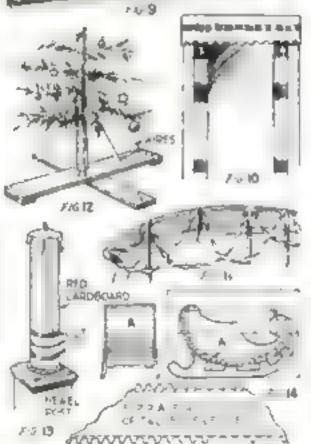
How to Decorate for Christmas

I me sale a free jug

honettes suggested for latter is may be developed on a much larger scale. Some wordows require only a plant bolly wreath with a bell inside. A window or two may have an open curtain effect made with ribbons of erepe paper and bells, as in

In Fig. 5 the curves of the paper rope are held in place either with wire or basketry reed.

Stars, large and small may be used effectively on a window, as in Figs. 6 and 9. The rays are formed with tinselcord. A common kitchen eleanser that



a simple tree stand, and a ministrary strick

leaves a white deposit on glass can be used for cloud effects.

A window may be covered with green Christmas wrapping paper, in which stars have been cut out, and pieces of colored gelatin, such as may be obtained at motion picture supply stores, fo-tened to the luck of the stars with rings of paper

For a design such as Fig. 8, start at one corner sticking on strips of paper about 12 in wide, use mainly red strips with a few green, or vice versa. Some fine basel. distributed rather carelessly over the stops will add life to the design. There are endless possibilities in such an arrangement of paper. A spider web may be made with narrow strips.

trebes and doors call for festion de-

signs. In switce og tot g festeres, it is hestto have one end of each curve a gner town the other as a Fig. 11. In other words, the curve should not be too regular, as in hig 7, every nerves small openings.

A somple treatment is rationing doorway. is shown in Fig. 10. The S in, wide rec har grigs at each side have cross bands of green, the top is green with a red stripe.

THE best place for the Classings free a usually is in a corner of the room. All sorts of bases can be made. Perhaps the supplest is that shown in Fig. 12.

The decorate of the Christmas trehas been developed to such a fine art these days that no parections need be

As the tree appears to best advantage. when lighted, the practice in some houses is to leave the shades drawn on Christians. meeting and the archem lighting direcg the distribution of the gifts. The effect is enhanced if the ordinary lamps in the lighting fixture are replaced with globes sant have been dyed red and green

An open stairway offers a splendid opportunity for decoration. A large caudle may be mounted on the newel post, as in Fig. 13. This is a cardboard roll covered with bright red paper. Some real paraffin at the top and a large wick give a realistic appearance. It is still better to use an electric candle-flame halb.

For Class may decree the whole tablecloth many be decomited with a red crepe paper build about 2 in wide applies about 3 in up from the lower edge of the drape. Four sun lar hands are run gerose the top of the take about 1 ft. Irom the edges at Coundle to them

Variable routine method acto one a 12 ne wide strip of red across the repter of the table and a summer strap lengthwise.

A green rectangle of crope paper makes a good foundation for the centerprece, On this use cotton for snow, with a generous sprokling of artific all snow

When there are children, a reindeer a a Sarita Claus or iterpiece, as shown at the top of page 74, is especially appropriate

bix small composition reinfeces, alimit 3 on, high, are placed in pairs, with ample room between the page. If a cardioard sleigh cannot be found, one can be made of red paper, as suggested in Fig. 14.

COMPREHENSIVE article how to set up a Christmas tree keep it fresh and make the decorations was published in the December, 1925, HARDE OF POPULAR SCIENCE MONTHLY; another article in the same issue told how to prepare a Yuletime decoration for over the mantelshelf. A method of concealing the base of a Christman tree with a glittering snow mountain was the subject of a long article in Decomber 1974. Either one of these issues. may be obtained, so long as the supply lasts, by sending 25 cents to the Circulation Department of POPULAR SCIENCE MONTHLY, 350 Fourth Ave., New York

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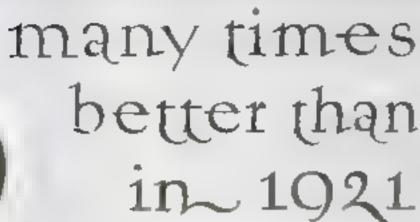
Make Better Mechanica

Making a Picture Frame with FEATHER JOINTS

By EMANUEL E. ERICSON, Noted Manual Train of twin erry



6 When glue is dry, it is time to trim "feathers" with chirel and plage



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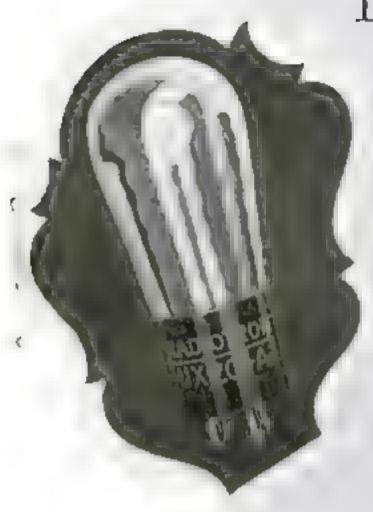
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AOUR SINOD

There's Fun in Painting Toys

How to Obtain a Professional Finish, Smooth and Brilliant-Materials and Colors to Use

By BERTON ELLIOT

THERE'S nothing like doing your L Christmus shopping early boughed Mrs. Andrews, pointing to one of the packages she was carrying. It had been broken open a bit as she entered the crowded bus and something rist and along was visible through the torn paper. I've got one of the eleverest mechanical toys you ever now "she confided "I bought it at one of the little shops along the avenue. You know, we hadn't expected to love any loys this year. John's been making out Ever more he began read-

ING POPULAN SCIENCE MONTHLY be's been making all manner of things, and they most all tuen out well. "Yes," she continued,

hardly stopping for a breath, "we ve got it all agured out. The tova nur kiddies got lated your we've going to paint up and give to a hospital. They will be just the same as new to the little boys and girls who haven't played with them before, and our kiddness will have some wonderful new play though to take the place of those they have outgrown or become tired of

"Im going to point the ones we give the hospital

but John says the ones he has been make. ing are her babies, and he wants to do every stroke on them, from first to last

"But do you know loweroug her voice. "we're a little bit afraid of the painting part. It seems simple enough, but I've seen some homemade toys that looked crude and amateurish, due nwee to the poor painting than to anything else. And Cousin Frieda said it was a slow job-hard to keep the kiddles from discovering the toys while they were setting around until dev."

Well Mrs. Andrews." I responded

"you and John drop over this evening and I'll give you some pointers. There really isn't very much to it, but like everything else you want to do it right."

Later on, just as we were finishing the evening paper, the Andrews came over

Now, about painting toys. I began. after we had exchanged a few remarks about other things of casual interest. "There are several different kinds of parating materials you can use. The one that has been most generally used as autocompel. It has a rich luster, comes in the brilliant colors that are popular for toys, and can be obtained in small cans It is also a little more tough and durable than the usual decorative coamels, and will stand better the extremely hard wear children give toys.

"Then there are the new brushing incquers. As a matter of fact, they are better idap; of for haisling toys than any other material. They dry m a few mintites, so you can get the job done and the toys wrapped up and put away before the loddies have a chance to come across

> them. There a another thing; kiddies always try to put everything in their months and bequer dries with a flortiske sorface which will not be inflened up and come off when

proceedment Is continue even by serateless off easely by sharp little teeth. And besides it is perhaps the most deraide type of finsh You know the sprayed lacrorer file asta on anatomobises can bardly be sentiched with a nai Breshing bequer will probably be the best nusternal for you to ose and the most fee

I pointed out that nother past, before the advert of brushing

lacquers, a flowborg material sometimes used to speed up the work was white shellar colored a thirty colors. That may tipe delet in an hour or so. The powstered colors are obtainable cheaply at almost any parot store and many who have had good results a th the mixture hes tate to try mustling else.

I gress we'll use un quer," commented. Mr. Andrews, and Mrs. Andrews modded

The colors," I continued, "probably have more to do with the homemade look of some toys than anything eise. Toys that you buy in the stores are usually finished in bright red or bright yellow Children are attracted by these brilliant warm colors, and toy manufacturers have found that where other cours are used their product does not sell. Therefore when home tox makers use other colors. the toys don't look natural and consemently seem cross and awkward. Another important thing is the proper balance of color. One color must preconnnate and the tran culor must be put on in about the right (! utuned on page 104)



Bright red and pelices in either enamel or bequesare the laworite colors for Christimes playthings



Responsive—
to your lightest touch

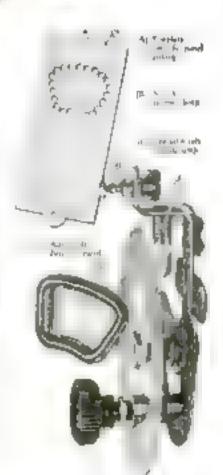
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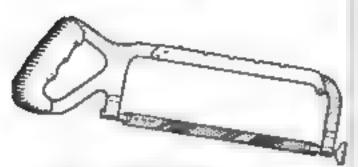
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STAR HACK SAWS



How to Utilize Your Cellar

One Man Built a Basement Greenhouse-Other Ways of Using Waste Space-A Symposium by Our Readers

WHETHER or not you are makyear hame, you will be interested in reading about some of the profitable and ingensous ways in which readers of Popular Science Morrier have utilized the basement space that in m often waated

The suggestions that follow were selected us the most practical from the

many acut in by those who read the article "How to Utilize Your Cet. lar," in the April same, and "How I Improved My Cellar by Making a Goal Vault on the May toxue While only two letters are published

in regard to the use of cellar space for a world-kep and sa connection with gardening, a large number of contributtoms dealt with the subject

By W. E. PYKE, Colorado Agricultural College

THERE are hundreds of thousands of L plant lovers in this country who can get a tremendous amount of enjoyment by landing a set of greenhouse frames just ontoide one or more of their cellar was-

Select, if possible, the ade of the house that will receive the most sunlight during

the waiter months, bearing in mind also the direction from which the cold writer winds generally blow

The ground should denni gently away from the frame on all sides. The front and ends should extend far enough into the ground to keep out winter frost, and the earth should be deawn up around the front and ends as a further msolution

The top of the frame should be built. regully and arrangest

so that it can be tightly closed in inclement weather and at night. If glass is used it should be inserted as in a greenhouse or skylight. The writer prefers to use either glass cloth or a commercial celluloidlike product and has found them more satisfactory.

An additional cover must be provided where the weather is as severe as it is in the porthern Mountain States. A blanket or comforter made of old woolens or cotton bats arranged as loosely as possible and covered with canvas on the upper side should prove satisfactory. If made in sections, the sections should be over-Inpped liberally,

The heat for the writer's frame is provided by keeping the basement windows that open into the frame wide open. The plants of the more hardy type may be bodded right in the frame, while those requiring special care are started in the

would uniform trave, which are brought into the basement through the windows at night and in severe weather. When the plants become sarge enough for potting. the poblace passed in trave made to fit the feame for convenience in handing These trays contain a layer of sand to r sure perfect drausage and to hold the pots

more or less firmly garbedded

For noil recopeprests, one should have a box of good loam, a supply of well-rotted akeep manuee or leaf mold and a supply of said. Many books can be obtained deal ng with this ambject, Suffice it to say that if the right methods are enplayed ancers will be attained, but the writer would not advise anyone who is not a lover of plants

to try the experiment. Small vegetables such as radokes and head lettuce car be grown easily. Flower plants su table for put outure in the house. can be started in the frame and a wealth of bloom can be had in the binise every month in the year. Moreover, balbs for winter bloom can be started in the early sprung from seed. The bulb can be brought to malarity in the early samuger and given its period of rest during the reinginder of the summer. The halb then may be potted up in the full for winter broom.

In localities where the growing again. is short lighted roses may be purchased from the greenhouses and graduany arcomated in the spring so that they will not lose their leaves when set in the open ground and a much longer period of bloom will be realised the first year.

There are many flower plants that may he started in the frame during January. and February (Condensed on page 111)



A wealth of bloom every month in the year is inquired by this changily-built greenhouse



HERE are a few suggested Ster-ling gifts for making someone merry at Yuletide.

And for months thereafter, the owner of the Sterling device you presented, will realize you helped make better reception his pleasure. Each Sterling Radio Care-Taker or Inspector plays a prominent part in reducing troubles, simplifying service and adding to the convenience of the set owner.

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Mr Thurshee at the lathe in his workshop. He developed tin cast for makeou so used in reconstruction work for wounded toldiers

You Can Make Delightful Toys from Old Tin Cans

By EDWARD THATCHER

THEN my boy was about two years old, I searched the toy shops for a large tin becometive such as I remembered having had when I was a little closp, building to find one, I thought of certain tin caus I had saved up. There was a long extendental bestut the which would do nicely for a boiler, an adhesive tape box would make a formel or smokestack while a square olygood can would serve for a cub, and Hangest syrup can lide would make realistic wheels.

Here was an idea! I hurried home from the toy stores and set to work in my small shop. In an hour or two I had the lossimative nucle, much to the delight of my small boy. It looked the part: moreover it was strong, and after many a elattering trip over the aidewalks of New York we still have it.

At that time our whole college (Teachers) College, Columbia University) had been turned over to the War Department for the tearning of the occupational aider for bospital service in the Wield War. In common with the other instructors, I was doing my best to think up some-

thing worth while for this work.

Tin can toys seemed to be it and they were. After reampleting the locomotive I made a steam roller, using a can fee each roller. and another one for a boder, a flat tobacco can fee a tank, a small flanged hd for a seat, a bottie can for the steam gage, and so on I made several other models and exhelated them to the authorsties in charge

of this work. They approved to such an extent that my entire time for more than two years was given over to teaching tim can toy making.

One of my pup is first took that work

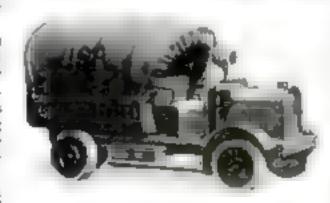
to hearne and I have some ortegesting pictures of the ran task made within sound of the big guns by the wounded in a base hospital

They not only made tays, but sonk linings, denois, lanter is and exhibit eloc Christmas tree ornaments, and many other things. This work soon spread to other hospitals both 'over there and here at home, where I am giad to my that it beloed many a poor chap back to some interest in life

Wilham Campbell, my able assistant in teaching this work at college, was of great aid. He first saw the possibilities in I n can toy making for public school work. So the work spread in other schools at was featured in the newspapers. the movies and had but not least, came a wonderful letter, from the British

Impresal War Museum, landsking me for my tao can toy models which had been seit over at their resided with other American war These toys are still there on exactation. And it all began in a very small home workf mfrancest about

on page 92,



A realistic model of an Army motor truck made abmost entirely from old came



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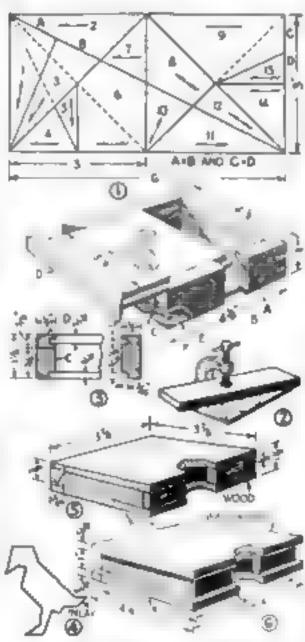
(d. Carta Arrend



How to Dress Up the Puzzle of Archimedes

IF YOU have fullen under the fascinating spell of the Stomachion of Archimedes-the famous puzzle that drove men wild in ancient times, and, after a lapse of two thousand years, has been revived and made the subject of a prize contest announced last month in Port LAR Science Mustime -you certainly will want to play this curiously integuing game with something better than a set of cardboard pieces.

A really fine set of the triangles with a case to preserve them will not take long to



A method of laying out the triangles, sog gestions for making different types of cases

make. It will be something you can bring out for the amusement of your family and friends for years to come. Such a sel-too. would be a splendid Christmas present because it would earry with it the appeal that always accompanies things that are handmade and example the purchased in the

The puzzle preferably should be made of 5- or a-ply wood or of a hard compontion is in thick of one of the types used for rathe panels. Any wood of course, can be used, pieces from a eigar box will serve if no harder and liner wood is available. Even a set made Continued on page 88







Eveready's exclusive Layerbilt construction makes this the most economical Eveready "B" battery

IMPROVEMENT on top of improvement has been the history of Eveready Radio Batteries. Here, in the radically different Eveready Layerbilt, is the "B" battery which tops them all. The ability of this battery to give you unsurpassed service and economy is due to its unique internal design. Instead of the usual assembly of round cells, it is built of flat layers of currentproducing materials pressed firmly together. This construction makes use of the spaces now wasted between the round-type cells and avoids the usual soldered wire connections. Eveready Layerbilt is every inch a battery. This exclusive Eveready Battery development packs more active chemicals in a given space and enables them to produce more current and give longer life.

Tuesday night means Evenesdy Hour-9 P M CARLETTO PLANTANTA LITTLE through the lettering Madagou WHAP THE Took WTAN-Clareland was heart. WALE Property mput Rector witc-Derenport wear Worrester mpr. Shi nabesphing were dannespille Wilde Baffafe. wied Pillebergh kot-St Louis Wash-Compound) unc-Fast patter Radio Batte -day kat kaper

This HEAVY-DUTY FYER-EADY LAYERBEET BALLERY gives twice the service of the smaller Light-Duty batteries and greatly reduces your "B" battery operating cost

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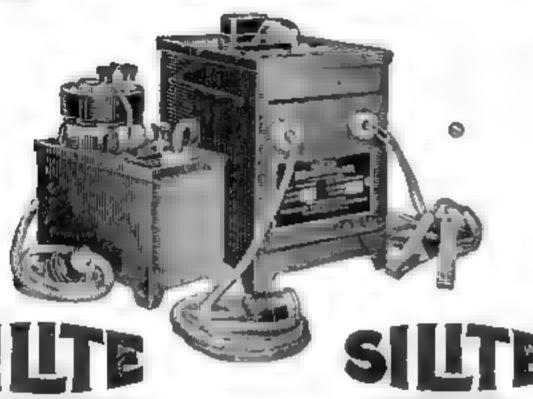
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Your battery troubles are ever, at last. New all codic power to in your light maket.

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Radio Receivers

Puzzle of Archimedes

Coul-aved from page 86

of fiber wallboard or of cardboard taken from a beavy shipping carton can be made. attractive if well flushed.

The first thing to do is to lay out the puggle as accurately as possible. How to do tho was explained last mouth, and the diagram is repeated in Fig. 1.

If earthward or wallhoard to used, it can be cut with a sharp kinfe; if wood or harder materials are used, the parts will have to be cut with a fine saw, and some allowance, therefore, will be necessary for the width of the saw keef

PERHATS the most convenient man to make the puzzle is on the basis of two 5 m. squares, as m Fig. 1, provided the nuteral is not more than 14 and thick-With 4, in thick material it is better to use 4-in. acturers, but such a set is a tribe cumbersonse.

If piymord or radio panel material is selected draw a reclangle Was by 64s to and lay out the parts within it so go to allow for the saw ker's and for forshing the edges. A straightedge clamped to the stock, as in Fig. 2 is an aid in sawing accurately to the line

In finishing the edges of the parts with file and analpaper, do not trust your eye entirely, but draw another diagram on paper within a rectangle 3 by 0 in, and use it to test each meee.

A slightly different procedure is necresery when ordinary wood is being handled. Draw the thagram the fin shed size on heavy paper, cut out the pieces, and then mark the wood so that the grain of each piece will run as indicated by the arrows in Fig. 1.

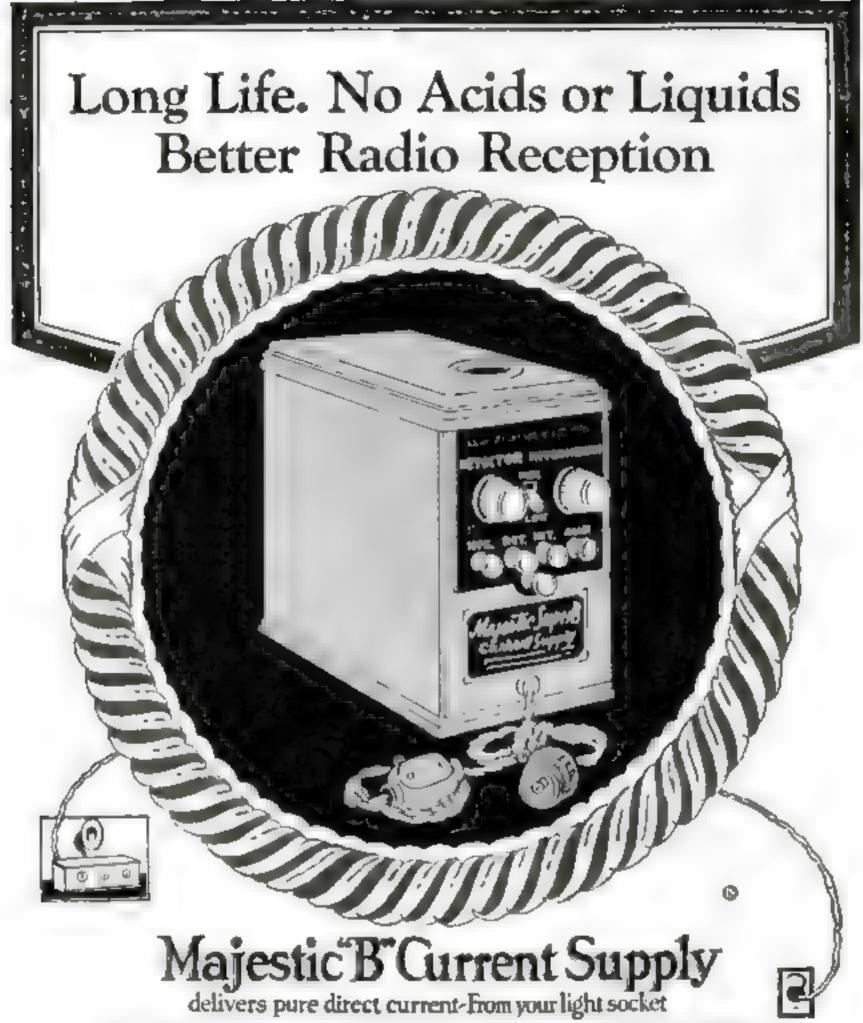
If made of wood, the game can be finished with one cont of stain, two coats of shellae robbed with No. 00 madpaper and, finally, a coat or two of furniture wax. An alternative method is to color the pieces with two coats of enamel or brushing lacquer. Compositions such as hard rubber will need no finish except on the edges; these can be shellacked, hequered, or varnished. The parts then can be numbered, if desired

THE game is not complete however, w thout a sintable case. No doubt the Greeks paid much aftention to the container becaus, the game was often known as the Localits of Archimedes and localus referred to the case or cell in which the parts were packed

For 14 in, thick pieces hased on a S-in. square, the box should be 3 1/4 in, square made and a trifle deeper than two thicknesses of the inglerial used.

A next case and one that requires fairly accurate hand work or the use of a fine cutting circular saw is that shown to Fig. 3. Thenner stock than that indicated may be used and the dimensions modified accordingly, but the lighter the how in made, the more skill and delicacy of workmanship are required

Prepare a piece of the selected wood 1/4 by 14g by \$2 m. long, cutting a groove by I netroved an page 90) in, wide by 46 in



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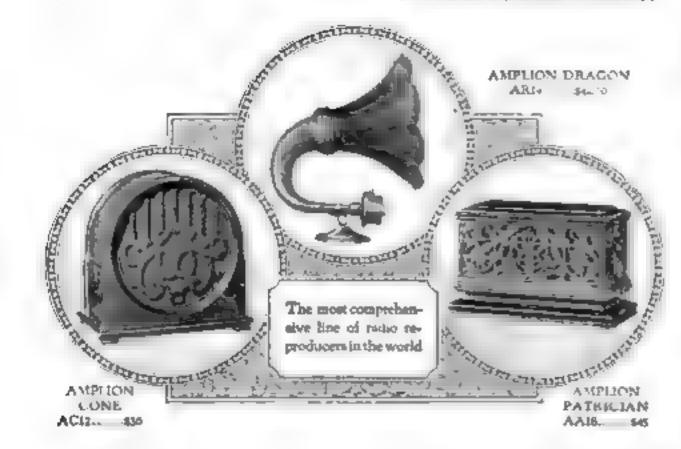
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The House Workshop

Puzzle of Archimedes

Carried tym (4)

deep, as at 1 and a rabbet 14 by 1/8 n. as at B. Cut five pieces with instered ends so us to be at a n. long on the made Cut the groove from one of these to leave piece C and from another, to leave piece Glue piece C and three others together. When the glue has set, make two narrow saw cuts at each corner, as at E. m to which splines may be glued. The splines (F) are thin stops of wood with the grain running lengthwise. Plane the projecting edges of the splines flush when the glac has lucatened

Make the top of all in material Rubbet the edges to fit the grocyer A on all sides and give one end on the rabbet of preseD. Make the bottom of Span, stock to fit the rubbet Band fasten with small brads.

BOX as well made as this deserves A the finest possible frush One way of ornamenting the cover is to aday it with a suitable design, such as nuggested in Fig. 4, or one of the solutions to the pazzle illustrated last month. Cut this from a piece of veneer or from very thin wood, his it upon the top and muck around it accurately with a sharp kinde. Make the knife marks pearly as deep an the thickness of the mlay, and then remove the wood between the lines with a kinfe, flat gouge or closel. Have the recess unform in depth and a trifle shallow rather than too deep. While the design at place and when the give is hard give it a cost of she lat. The next day, mandpaper the design flush with the surface of the top. The box then may be finished with shellar and was beginn or various

A case of an infrarquer construct car is show an big to Cat (wo ends and y and y 3 or Ovalsides 3, by \$4 by 92 air and two pieces for the top and bottom 1/4 by Carts Cart. Not the corners with for No. 18 brails. Then make two huge preces if soled limits on the and fasten with small trass had san shown.

THE top of this box can be left plained A decorated with a design like Fig. 4 drawn in black drawing our after the wood has been given a thin court of anelliar. In that case spray another cont. If very this suchee on a thorourbst's fixative blower, a perfune atomizer or a small gambispray, so that the design will not be blurred. The box then may be finished with another cont of sheline and two conts of furniture wax.

Fig. 6 suggests a method of making a box of fiber wallboard. Cut two engs I by See in two sides I by 33 a a bottom \$1. n. square, and two pieces for the top, one 114 in. square, the other 3 is the square. Give the sides and ends at the corners and when the glue has set, fasten this run to the bottom. Also give the two top pieces together. This top requires no hanges,

The wallboard box should be finished with colored enamel or lacquer. It can be ornamented with a deagn cut from thin colored paper, pasted smoothly upon the top, and given a protective conting of clear variesh or lacquer.





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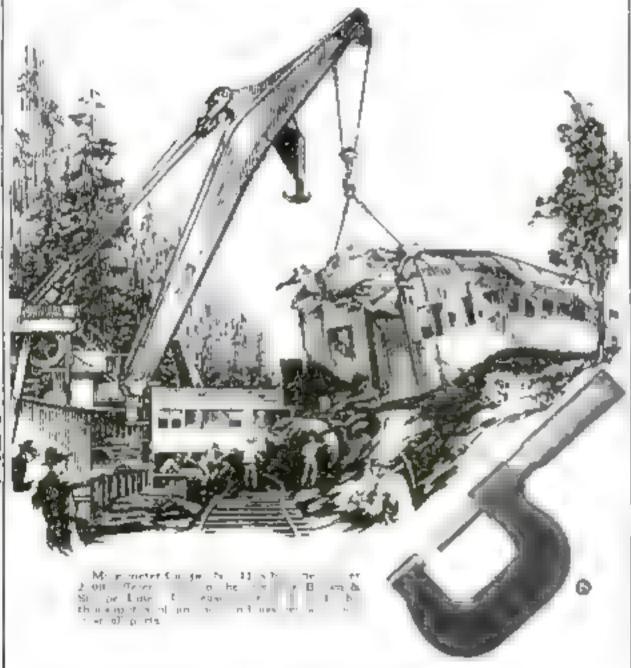




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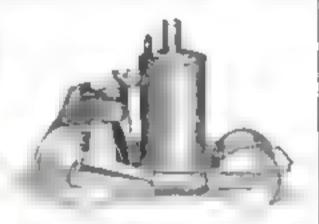
Tin Can Toy Making

Continued from page 84

Of all the tin can toys, the steam roller is one of the most typical models. The was a great favorite with the wounded soldiers,

The illustration on page 94 shows how the different cans are combined to make this toy. The boiler is soldered open end down to the crossoseve between two strips like channel iron. These make the asies of the frame. These strips and the crosspiece are made from flat strips cut from tin taken from cans, flattened out and folded to shape.

The front roller is made from a condensed or evaporated milk can, as these cans are usually emptied by punching two holes in the top. After the can is emptied it should be sanked in but water and all the water emptied out before soldering up the holes. A hole is panched in the center of the ends of the can and a piece of staff were soldered in for an oxle. Between each end of the can and the



A soldering cross and tun uniqui are the principal tools needed for making toys like this ...

frame is a sort of washer nuide of a narrow strip of tin rolled around the axle as

The rear roller which is larger in diameter than the front is made from a toristo can, or rather two tensate cans of the same size. As the tornato can is longer than the condensed in lk can, it must be cut down. A fine is scribed around it at the proper height and to ner's so ps are used to cut away the extention. Hold the open end of the can toward you and cut from right to left

The bottom is next cut from another tomato can of the same size in such a way that about \$4 g in, is left intact above and around the bollom. This pay be done with a sharp can opener cutting around the sides of the can, or by cutting spirally down from the top with the staps, again from right to left

The ring of tra left above the bottom of the can is slit to the bottom of the can with cuts about \$\Q\ (6. apart. The can that is to be used as a rober is their placed. over a piece of pipe or similar anvil and the cut end enlarged sughtly by hammering it so that the boltom of the other can will fit in it after the notched pieces have been hammered in slightly toward the center of the can. When the pieces fit meely together, they may be soldered in place. Rollers and wheels of many (Continued on page 94. dampeters and

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- 3. Here was the earth formed?
- 4. Why is glass transparent!
- 5. How do we know that the earth is showly shrinking! ...
- 6. What is an electric current for-
- 7. How was putroleum formed! -
- De plagerous really nove through wea when an electric current is flowing through it i....
- 9. What physical changes in your hody are produced by feer?
- 10. How do muscles exert power land
- 13. Can we see atoma with a microecope I + +
- 13, Why does heat sepand things and cold contract thought ...
- 14. Why does the moon appear to thangs its shape from time to time?
- 15. What is the brain made of fa-
- In. Why is it possible that the inside of the rooth is growing hotter instead of colder? -
- 17. Why is frost more likely on a clear night than on a cloudy one?
- 16. Does thinking wer up the thinker's energy !-
- 19. Which proved factor, electricity or light!
- 20. What simple test will distinguish wool from corton?

- 24. How do the living cells of the
- body get the energy with which to do their work? 25. Here is the speed of light mea-
- oured t

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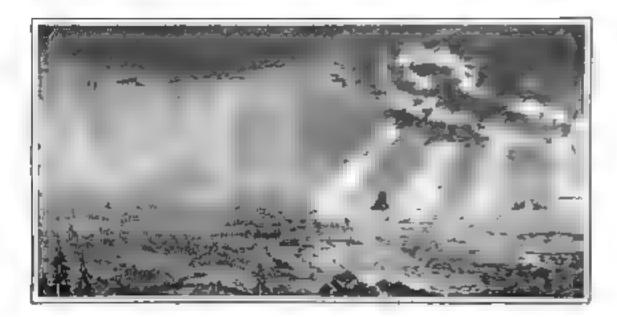
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This seel as a radio, tool or oil hurses advertisaseest signifus the approval of the DATHVE OF STANDARDS. See page 4.



Rain and Telephone Calls

THE annual rain full in the United. States would weigh over three and one-half trillions of tons.

This yest weight is drawn up to the clouds by the unseen but effective power of the sun; representing energy equivalent to three hundred billion horsepower.

The annual telephone conversations total over twenty-five billion a year. As silently as sunlight, electricity, mastered by the human mind, carnes the voices of the nation.

There must be the man-power of 300,000 individuals to build, maintain and operate the telephone system.

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Saw Table 12° x 14° tills 45° de x Spare 1° stook. Pace blades 11° to 16° wide to 15 wide Bronse Bearings.



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Junior Saw

Does ripping patersing, growther candidate a noting and deriving with rases and deriving with rases and deriving with Paties 1, to Nakes moulding bold with an with-



Tome Workshop

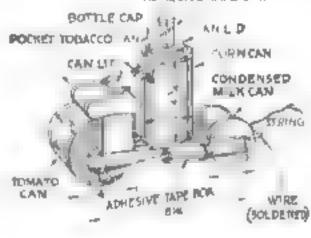
Tin Can Toy Making

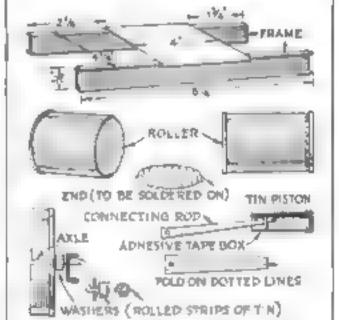
, and much from page 92).

widths may be made from cans in this

Another method of making rollers and wheels is to use cans which have scidered caps on each end, such as condensed malk cans. These caps may be melted off in an open flame. A slight knock with an edged tool will remove them when the solder as melted. Another can of the same kind is cut down to the proper width and the piece picked off the first can is soldered in place. It will be found that the end melted off the first can will have to

ATHESIVE TAPE BOK





How the steam coner is assembled details. of frame, rulers, and posters mechanism

be enlarged slightly on an auxil before it will fit on the end of the second can.

The tank to which the sext is prompted. is a pocket tobacco can. This is solucted to the two upright pieces, which are, in turn, soldered to the frame.

Strips of the may be folded into angle or channel-like forms in several ways. The support is, of course, to use a regular folder such as the timeer uses. The next best is a wooden roofing folder. but this is not found in the usual tinker s shop.

Two pieces of hard wood about 4/ in, thick, ₹ no wide and x2 m, long may be made into a summer folder. These are placed in the visc, paradel with the jaws. The pieces shouts be firished off in such a way that the upper and outside edges of them are chamicred off sharply at more than 45 degrees. The strip of tin to be folded is placed. (Continued on page 95)

Tin Can Toy Making

(Continual from page 24)

between these wooden paws, the vise is screwed up firmly and then a mailet is

used to fald over the tra-

The cylinder on the inde of the steam. roller is a tin adheuve tape box, or a piece of tin rolled into cylindrical form. with a bottle cap soldered over one endfor a cylinder cover. The connecting rudis a folded strip of tip, one end of which is suddened to a disk of tim, for a juston. This disk fits loosety acto the exhader. The crank for the rear roller is a piece of stiff wire bent to shape. If galvanigest wire is used for the front rober axle and the crank axle of the rear roller, you will find pure muratic acut best for a soldering flux; soldering paste or "killed acid ' or the best flux for lin.

THE steam gage may be made from a bottle cup soblered to the top of the boder, tuned rivets may be soldered to the side of the boiler for trycocks; a small .22 calber shell for a whistle: a small can lid sublered to a piece of wire makes a steering wheel.

When making the tin toys you will find that an ice pick or marking awi is an ex-

redent panch for small holes.

Remonber to have all metal to be scadered bright and clean. Your soldering copper must be not enough to melt the solder casely and quecky, but if it is too hot the Lining at the point will be sideed or hurnt away The copper ther will be useless until it has been filed. bright and retrined, by heating it, covering at with flow and rubbing it in melted. in der an a well fluxed piece of tin

Remember, too, that the soldering couper must be left in place long enough to heat the joint to be soldered to the metting.

point of the solder.

After the war we determined to pullup stakes and move to the real country. and make to see by we came to the shop. m which I am at present at work. This is located on a hillside, back of the house. . The site of what was once a tremendous stone pile.

MYFATHER and I built a track over 250 ft. long, using chestnut twoby-fours for the rails. Later on these rails" served as framing for the shop I car was made with a set of wheels from the pink yard. When loaded, this ran by gravity down the track, back of the louse, around a curve, over a bridge, and so on out to the new stone pile. The wooden ran a propost Or Curve Were Interwith strap icon. An incline at the end of the track stopped the car. We loaded and sent down 396 half-ton loads before we could begin to build the new shore

At last all was ready to start building and my boy Mike deove the first spike in

the timber sals.

Local carpenters finished this frame and put on the roof. Father and I put on the stating, laid the floors, put in the windows, boilt the stone forge, and at length compuried the shop as it is

Ter main floor is divided into three (Continued on page 16) parts such as my

NEW POLICY for the **BUSINESS MAN**

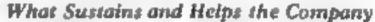
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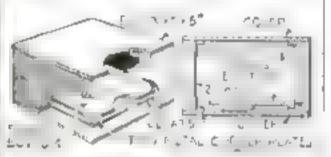
hork fined learnement to Dept 32-1 timed Repits, Michigan, hes, send me here I axalog without obligation.

Addense

This Magic Box Causes Coins to Disappear

COPAS, rings or any small articles less than 4 in thick can be made to disappear and appear again mysteriously in the simply constructed box illustrated This box will astonish an audience of young children

The performer places the box on a table, around which the children are allowed to stand, and, opening it, asks someone to put a com or ring into it. He



The box has two covers and a freely-sliding falm buttom for concessing small objects

replaces the cover and goes through what seem to be meaningless motions.

When the box is replaced on the table. it is found to be empty. First is because it has been turned upside don't and a diplicate cover opened. The object is hidden by a thin, slating false bottom. guided by metal corner plates as shown. The object is recovered by revening the a operation.

The box run be usade of scraps of woodand had best be painted gray usade and blue outside. Devolo W. Clauk,

Tin Can Toy Making

(Conferent from page 16,)

previous shop expensues laid taught racwould be convenient, particularly during the cold wraters. In the main shop are loeated the forge, blower and anyil, gasoline engine, engine and speed lather, circular enwe (large and aniall), bandenw, graidstone, post drill, bench drill, grinding and polishing head and poster, all power drayen. There are several dynamos of different voltages

Back of the firge is another some shop, coundate in itself, in this are the lighter tools for beach work, soldering. brazing and so on and a small speed act reand a grade ig and poledong head. One of the line shafts rung into this shop,

I ac other room on the first floor is also complete in itself as to right up and rest. ing. In this room are many of my books and considerable radio escipinei t

Into this last sleep I have tried to be part everything I have learned about shous. Much of the equipment I make investi as I find I need it. The juck yard a a happy hunting ground shafting, pellevs, belting, gears, and many other things I find there but I never buy jurk ungess with a definite idea of using it

And so, to conclude, I find that my shop has done practically everything for me, as I trust it will do for years to come

This is the concluding article in Mr. Thatcher's series on his adventures in toolcraft, which began in the September issue

Brushing Lacquer

Continued from page 69

and that next. This grip enables one to back up the paper with his hand, which is an ideal pad. By dipping the paper rate the soap solution, then into the pumice-whiting mixture, and rubbing it on the lacquer, we were able to cut down the surface faster than we had expected.

We were very careful to rub only in straight lines parallel to the floor. As often as the paper became giazed, we discarded it for a fresh piece.

AFTER Dan had made a good start, I followed him with a hard, 14 in. thick rubbing felt dipped into the pumicewhiting mixture. I used plenty of soap solution to keep the surface wet,

We cut such section completely before starting on the next. As soon as the work and been rubbed clean. I washed it off with water and a sponge, then chamosed it dry so that I could examine the surface for parts not rubbed enough,

Our next process was to make a mixtore of vinegar, one part; light machine oil, one part; rottenstone, one part; and water, three parts. With an old cetten flannel cloth folded into a square pad, we polished the surfaces to a brilliant gloss. Last of all, we used a commercial polars puade especially for larguer.

When we were through the job was like a mirror, for I could see the beads of perapiration on my head just as plain as day. But it was worth it.

"TOW that I have the hang of it," Dan commented, "it seems to me that it is t a great deal tougher ribbing than on varnush work. Anyhow, it eertainly pays to rub out the body like this, I really can't say that I like the eggshell fimale at looks like a lazy man a job,

"That a the way it appeals to me too. Dan. Do you know, now that we have gone this far with the job, I believe I will take the car over to Jones and Haddock and have them do a little striping work."

And so about two o'clock that afternoon we drove over to the auto shop and had the stripes run on the body. Then I let Dan take the wheel.

"Inst leave me at the laboratory," I sawl, "and you can surprise Mother with a ride for the rest of the day "

And Dan drove off up the street as proud as a peacock.

This is the second of two articles on finishing an automobile with brush ing lacquer. The preparatory steps were described in detail last month. It should be noted that in buying brushing lacquer for use on an automobile a brand should be obtained that is recommended by the manufacturer for this work. Not all lacquers, any more than all enamels, are intended for such an exacting service. Furthermore, not all old finishes will stand the solvent action of the thinners used in Incquere, so that the car owner must use his own judgment and make a preliminary test on some incompicuous part of the car, if he thinks it necessary



WITH the Christmas holidays drawing near, what gift is more useful, more appreciated, than a gate leg table made with the help of your youngster - and good tools?

To shape the legs and cross pieces -to round off sharp corners and smooth rough surfaces - use a NICHOLSON Cabinet File (made especially for this purpose).

There are many NICHOLSON Files to do the many jobs around the house. Let your local hardware dealer help you select the right files.

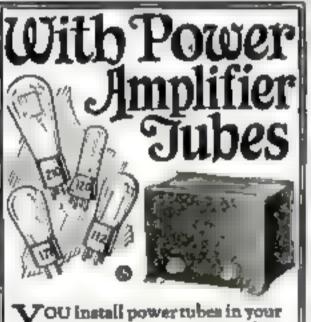


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set to get purer tones and to eliminate distortion.

Concertones have a large enough core and winding to receive the lowest notes from the tubes and to reproduce them without distortion or "blasting." Heavily insulated.

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A L-2 BEALS DIMER PERMITS TANKSPORMERS



You ought to have this handy Parks in your shop. It is a compact, complete mathine designed just like a big production outst at one with the cast. Includes 8-inch circular rip and cross cut saw with polished cust-steel saw table, 10-inch band saw with tilting table for bevel-sawing. 6-meh jointer, and motor operating from any light socket. Just plug in and go to work! Fits it a corner of your basement. Does any kind of tabinet and jumery work. Add lathe, shaper and other attachments any time at small cost. For the man who does "odd jobs in his off time this Parks is a big money maker Turn out as much as a four-man shop working hy vourself

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Godesand - I -

Toy Birds and Animals

A mid. worker . Tops James G.



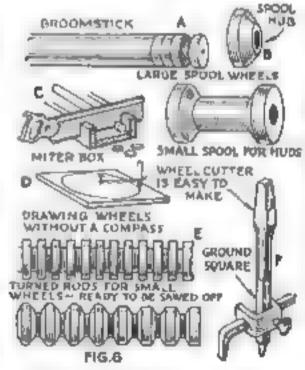
More toys from Mr. Hughes' collection. He sa a speciment as their construction

corresponding proportions. There is enough variety to keep you busy for weeks

If you have that blueprint, you can transfer whatever designs you wish on the wood by means of typewriter carbon paper. Another method which is quicker if you intend to make a quartity of the toys or laive the children help with the work, or to paste the various designs or bristol board or tough, thu cardboard and then cut them out so that they can he used as templets to trace around

Attention is called to the character of most of these forms, with their simple I ses and large feet. If these forms had not been Changed in this way the smaller. parts would spat when cut from wood-Tack in most cases should be removed entirely when sowing and leather or twineadistri ried

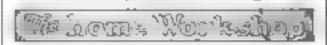
It will be noticed also that all of the illustrations of books on Fig. 9 show on y one leg, and of the animals, only the



Bronmsticks and speeds as used for wheels methods of turning wheels, a wheel cutter

cow has all four legs. This sumplification if the toys are cut from one piece of wood, nakes the work casier and the residt more satisfactory from the standpoint of durability

You are not limited to these designs. Many partures of animals may be found in hooks, magazines and newspapers, and these may be (Continued on page 39)



Toy Birds and Animals

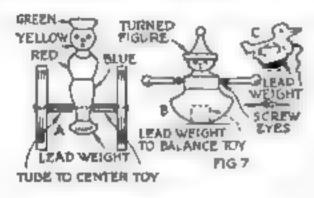
(Continued from page 98)

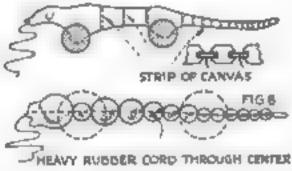
made adaptable to wooden tovs if suaphilied in the light of the designs shown.

If a toy is to be cut from posser boards. the grain of the wood must be considered and made to run in the direction best serving to strengthen the weaker parts. The different drawn gs in Fig. 9 have arrows to majeste the direction in which the grain of the wood should run. If threep y wood is used, the grain mually can be ignored.

What thickness of wood to select depends upon the size of the toy, the form of construction, and, to a leaser degree, upon the kind of wood. Three-ply parts can be thomer than those of solid wood

An elephant made the size abown on Blueprint No. 56 should be 14 in, thick if a





Toys weighted so so clways to remain upright wiggle" toys with jointed bodies

single prece, and 14 or 14 in. thick if in three parts. The now, cat and donkey should be 1/2 in. thick if single and his in. if in three pieces. The birds and fowl may all be 14 in. thick.

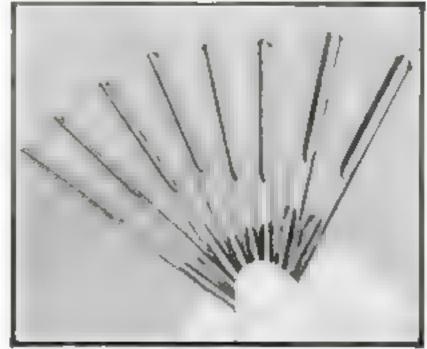
The duck can be made into an especially attractive toy if cut from 34 in. thick stock with the head acpurate and loosely doweled in place so that it will turn. The puppy looks best if 14 in thick.

After the toy has been cut to shape and smoothed with a bit of sandpaper, the kind and style of base should be carefully considered, because the base has much to do with the general attractiveness of the finished acticle. Each individual toy seems to call for a special type of base and the form should be studied with this in mind. Some toys look best on a round base, others need a square base.

If wheels are to be used on the base, the size of the wheels should be considered in relation to the waith of the base. As a general rule, the width of the base should equal about one half the height of the toy

In Fig. 3 are snown a number of bases. A and B are removable. In the case of smaller animals for a Noah's Ark and other col-Continued on page list

To bore clean holes quickly -- easily without splitting or cracking



Here are the eight different size drill points

Use Mr. Punch the Goodell-Pratt Automatic Drill

*HIS automatic drill makes holes of any diameter from 1/16 to 11/16 of an inch-and does it quickly-and clean as a whistle.

You push-Mr. Punch twists. No skill is needed to do the job right. No cracking, or splitting, or splintering. Hard wood, soft wood, plaster-are all alike to Mr. Punch.

A hollow space in the handle is divided into 8 compartments, each to hold a drill point of the size marked on it.

To get the drill you want, just turn the cap so that the top hole is opposite the compartment the desired drill is in. The point is released through the top hole.

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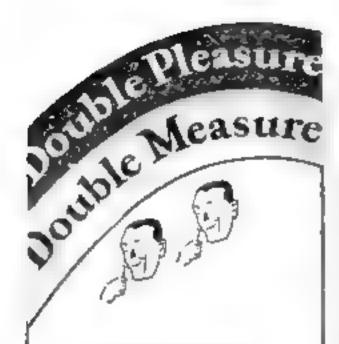
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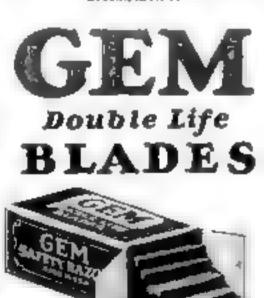
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GEM SAFETY RAZOR CORPORATION Brooklyn, N. Y.



Toy Birds and Animals

(Conference from page 99)

lective groups, a small cardboard disk glued to the foot is sufficient.

Wooden animals may be made up in a single piece (A. Fig. 1), or in three sections nailed together, as at B. For bards and fowls either a base is used or wheels with a counterbolance (Fig. 7).

Small wheels may be made from a brocourtick or curtain rod as suggested at A and C in Fig. 6. A stop block placed in the miter box helps to keep the thickness uniform. Two styles of small turned wheels are shown at E.

In Buding the center and drilling the boles in all of the wheels, care must be observed, or they will be one-sided. A ng with a fixed center can be devised to aid in drilling these centers.

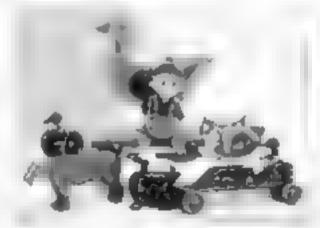
For drawing the larger wheels use a compass or pair of dividers or the method

shown in sketch D. Fig. 6.

If a washer cutter, such as used by steam fitters for cutting gaskets, is to be had, a very good set of wheels may be cut out, provided the wood does not exceed by in in thickness. A satisfactory wheel or waster cotter may undeed be improvised as shown at F. Fig. 6. The shark is made from an old auger bit

The larger wheele may be varied in appearance by using different halps with a plain wheel, as shown at B. Fig. 4. Tin roofing washers used for hubs give nent booking wheels. Again, several holes may be bored as shown at C. Fig. 4. In the same group E is a pointed design that looks well on circus wagons, carts, and the like. At Diace shown some examples of torned wheels of various designs.

Spinifies or bearings for the wheels may



"Eqts" may (untly be used to describe some of these brilliant and charming little toys

he of several different types, as in Fig. 3. Among the newer wooden toys on the market are to be found some very at tractive little wheel toys that are weighted so they always remain in an unright position. Figure 7 (A. B. and C) suggests how several of these lattle povelties are made. Beads sometimes may be used as aparers instead of tubes as at A

Some of the semi-mechanical animaltoys in the toy shops have one end brazed so that the other can be moved up and down by an eccentric in one of the axies. The principle of the eccentric is indicated at G. Fig. 3.

The pointed toy made in several sections and arranged (fontioned on page 101)

The Crown Fuel Saver will give more heat, steadier heat. than you ever before succeeded in getting from a given amount of coal-and will lower your coal bills.



You can have the cosiest, warmest home this winter by simply attaching the Crown Fuel Saver to the feed door of your heating plant.

By doing so you will save at least 20% of the coal you usually pay for-get decidedly more heat from the coal you burn-reduce the number of firings-and keep every room livable and comfortable

The Crown pays for itself

in comfort alone—in healthful heat that conquers cord and dampness. The Crown pays for itself in actual money that we absolutely guarantee the frown to save at least 20% of the coal you ordinar y use, or we will refund its purchase or ce without argument

Figure this 20% saving for any period of from a year to ten years on the basis of the amount of coal you used last year Quite a considerable sum isn't it? A rig enough savings to make it worth while for you to investigate the inexpensive Crown Fuel Saver

Works automatically

The Crown is easily attached to the feed door of your beating plant (put it on yourself or art some buildy author to do it - works automatically mercal gets out of tender

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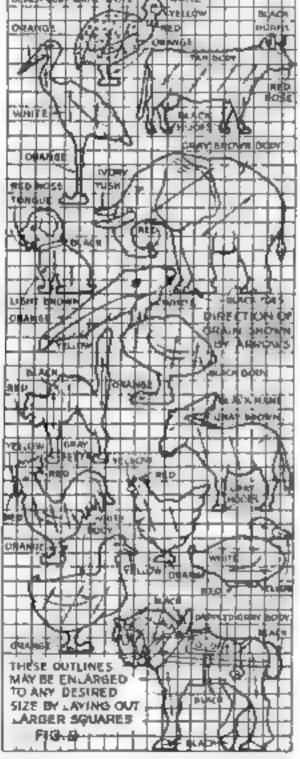
Toy Birds and Animals

Cantinued from range a D.)

to wiggle when it is drawn along is always. nteresting to the children and quite simple in construction, as shown in Fig. 6.

The main points in successful toy making are sample lines, solid construction, and clear, bright colors

For most of the smaller toys the gloss paints, curriage or auto enamels and



Full size templets of these toys are contrined in Blueprint No. 56, See page 192

colored lauquers have been found most satisfactory For ample work the three prunary colors, bright red, clear, brilliant tilge, and vellow, with the addition of black and white, are all that are needed. These may be combined to form all the others. The work should be given a priming coat first, and when this is dry, the colors applied in the order of the lightest first. As a rule it is best to let each color dry before applying the others, Eyes and small lines may be added with the point of a nail or a toothpick, if a small pencil brush is not at band.

For additional suggestions about painting toys, see page 80.



Saul Ec-centric Cone

where on the principle of the melo-droue here with its short and long strugg, the short and long sides of the Ec-centre Cone provide whenting men-for both loss said low motor. Com-pletely eliminating losses or herest scar. Operator myselly well with or without power amplifies, Price, \$25. Junior model, \$15. All press singlety higher most of the Recises.



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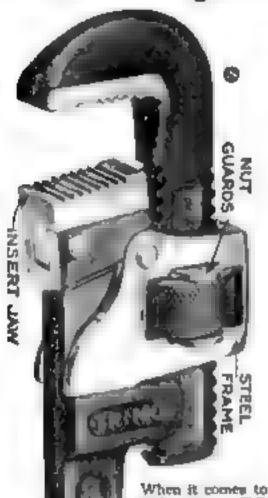
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Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The corresponding back usue of the magazine, in which the project was described in detail, can be had for \$5 cents additional an long air coroes are available. The Editor will be gladto answer any specific questions relalive to look, material, or equipment

POPULAR SCIENCE MONTHLY 250 Fourth Avenue, New York GENTLEMEN

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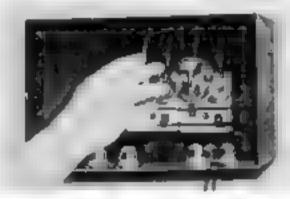
The Trick of Making a Fuse Chart

By GEORGE A WILLOLGHBY

Supercome of Everen Work Arthur H.A. Teade School, Soginam, Mich.

"You were going to show me how to make a fuse chart," Jack Rice remnided me, as he came across the driveway that separates our houses.

"That was't take long," I assured him, "Come in and we'll make one out for my house; then we can do the same over in your place. You see, there is a great advantage in having a fuse clust, became if a lamp fasts to light or any elecine device won't work and the tennole scens to be a blown fuse, it is possible to tell at a glance where to look for the defective fuse. It isn't necessary to hunt around for it as we did the other day when you had trouble in one of the upstairs circuits. There are only two fose blocks in my house, but, nevertheless. the chart is worth making. The chart for your house, which has more circuits



We removed two fuses, one from each block. and acrewed a lamp in each vacuat receptable

can be worked out in the same way First we made out in duplicate a list of all the lights and convenience outlets. in the house-kitchen centre light. kitchen convenience outlet, hvarg room center lighting fixture; living room convemence outlet, west wall, and so on There were seventeen.

Going to the cellar, we pulled the main house switch and put a lamp into one fuse receptacle in each fuse block, after removing the fuses from these two receptacles. We did not disturb the other two fuses. Then we closed the main awitch.

"By watching these lamps" I ex-plained to Rice, "you can ted which set of fuses protects each outlet You stay right here with one list while I go through the house and turn on and off everything in the same order as the outlets appear on the list, from one to seventeen. When ! the lamp in the first fuse block lights, put down number one on the list opposite the proper outlet. When the other lamp lights, mark down number two."

This checking process was curried out quickly and the completed chart was hing apposite the fuse box for reference. Then we went over to Jack's house and used exactly the same method to prepare a chart for his much more extensive wining system.



Handlest Tool in Your Work Shop

Printiple year have never the upts of the special advantages of a right Poor angular on the 19 and a major of the special section of a major of the special section of the special sect

Recips for Making LePage's Gesso

I'd maler out cup of LePage a Gene you need a golf can of LEPALES GLCE, 15 cups whiting I temperate meed of and 2 tempoors Temple. Place who are a mag less aways n skew o en thes the Phi F w teld li genera a and variety Man units among the A springer to write



Bottles, Tubes, Cans

Try this NEW way to improve your Craftsmanship

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WITH the coming of the long winter evenings, the best time of the year is here for the man with the Home Work Shop Hobby. What articles of furniture are you planning to make this wroter? Whether it is a radio calmet, end table, book case, cedar chest, or any other piece of household furniture, LePage's New Hooks can be of practical help to you

LePage's Pract cal Suggestions for the Home Work Suop," and, LePage & Gesso-Craft Bock," will help you come caser to equaling the skill of the trained calmet maker turning your evenings spent or his nobry to better account. They tell you how to make strong joints with glue, and not in y with glue, but with glue in its most convement form LePog 's Luguid G u

These brooks also show you now in year up smal acteets in your crides. manship howard, then a solwest p and an error is made. Or are are hopes to be found where he be or son wahave been countersunk. Or the edgest of a joint are not exactly even. A simple new way to repair these defects it with the use of LePage's Gesso eastend of putty. LePage's Gesto will glass, etc. It can be sandpapered, planed and painted or storned just like wood. We give you in the untail panel at left a simple formula for making LePage's Gesno, but of course we tell you more about it in the books them selves, together with practical informaion on decorating your finished arracks or h Gesso.

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Fun in Painting Toys

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amount and the right places, or it won't look right. It is a good idea to take a little trip through some toy shop, or the toy department of one of the big stores, and make a mental note of the color combinations.

"That seems logical" Mrs. Andrews clurped as I paused momentarily

The mechanical part of the work needs to be well done.' I resumed, "but there's really nothing to it, after the fine interior decorating you folks have been doing lately. In doing the new toys, the first step is to mindpaper the wood. If it is somewhat rough, cut it down to comparative smoothness with number one half mandpaper. Then amouth at off with number 00 sandpaper. Always sand with the grain of the wood

THEN I described in detail the process I of painting. It is, of course, quite possible to apply the auto enumel or begger directly to the bare wood, but a better finish is obtained and time a saved in the end by preparing the surface with a cost of white shellor. This seals the surface and usually saves a coat of the ensand of lacquer. The shellar dries in about half an hour, and should then be

anisdipapered aightly. If there are any cracks or imperfections of the surface, they should be filled at this hare with some crack filling preparation. Putty is all right if it is pure limited oil putty. The trouble is, however, that much partty is made with paraffin oil and this will begon to show through and discolor the painted finish soon after it lust been applied. There are crack filling seeparations put up especially for use on wood surfaces, they cost a little more last are much better. These will not discolar succonting paint coats, they dry hard more quickly, and are less liable to shrink and come out. One trouble with either of these materials for this purpose is that they should be allowed to dry until the next day before being painted over.

When it is desirable to finish up the work the same day, about the best thing is to mix up some plaster of Paris or whiting with white shellac or lacquer. This will dry so bard within an hour that it can be sandpapered level and amouth,

TWO coats of either enamel or lacquer ought to be enough over the sheling. but a third coat sometimes may be necessary. If auto enamel is used, allow fortyeight hours for drying, and sandpaper lightly between roots. If lacquer is used the sandpapering between coats may be dispensed with an fact at will be better not to sandpaper if you are going to follow one coat after another within an hour or so. Lacquers, while they are dry to the touch within a few minutes after application, continue to harden for quite a few bours, and if the lacquer is to be maded it should be dry clear through. Another thing to remember is that incouer will not stand so much sandpapering as oil paints and varnishes, and should never be sandpapered dry. (Continued on page 105)

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Oromfield Avenue Milwacha

Fun in Painting Toys

Continued from perperally

The dry paper scars the lacquer film. Get the special type of sandpaper made for use with water and keep it wet.

After sandpapering, always be sure to dust off the surfaces. About the only other thing to remember is to watch out for sags or beads forming and running down at the corners and edges, a so "cortains" on upragit surfaces. When seen, these should be "picked up or straightened out? with the brish at riger, before the material has commenced

As toys generally are more or less irregthr in design, care is essential so as 1-3 to cut through at the edges or corners to satisfue serring, and tool to in secarcy places. in applying each coat. Lock over every part carefully for skippen places.

In returning old toys, sumply wish them, sandpaper lightly and give them a coal of engine or larguer. One coat ordinardy a enough for a repaint job, but if not, apply mostler

"With these pointers we'll surely looke a good job of it," Mr. Andrews asserted when I had bashed

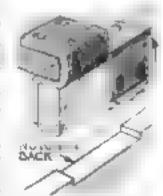
"There's one thing more 'I added "The fin sh wants to be flowed on smoothly and everly, without showing housts marks. You'll need good broshes if you want a good job. About a one and a half or a two men arish will do nierry for this work. And their you ought to have a smaller brush-about a balf men for pulling on the true color and other appli work 1

"Now then, we're all not for playing Sarta Casis!" exclurned Mrs. Andrews

How to Apply Leather Hinges

[EVIHER bruges, if used on the lids → of boxes or chests around the shop. and home, should such consist of two pieces. One is fastened to the underside

of the lid and passes through a recess in the edge of the hox so that at can be attacked to the outside of the buck. The adpacent piece is alinched to the outside of the top, passes through the peress, and is fastened inside the back. The lid cannot above forward and backward.



two leather strips

Eather serves or nails long enough to be chucked may be used for attacking leather huges. HAROLO N WITTHORE,

AN EAST WAY to remove but waste or other fuzzy matter from a metal strainer ir screen is to dip it into gasoline and light it with a match. The charged waste material then can be blown or shaken off. If the secreta is soldered, the waste must be lit and extinguished repeatedly to avoid any chance of the solder's melting

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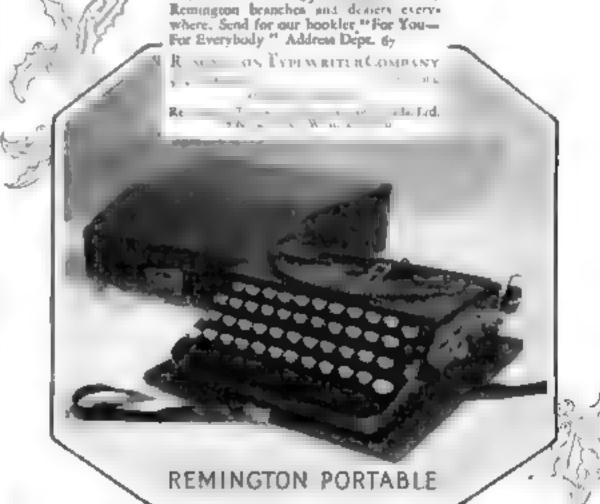
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The Marks White States

Automatic Block System

Landsnaged from page 30.

be hidden away under some of the scenery if you want to keep it out of sight.

The wooden arm is 1/4 to square and 5 m. long. A hole for a thin 1% in, word screw is bared through one end of the arm. Make the hole big enough so that , the screw will be a loose fit. Mount the arm on the base with one fiber washer. between the arm and the base and another under the serew head. Adjusting the errew will regulate the amount of effort needed to move the arm. The lower washer also supports the arm sufficiently far above the base so that you can wind on some soft from wire to art as an armature and still have the arm swing clear.

OU will need soft iron wire of any Y gage not larger than No. 14 to make the armature on the moving arm and for the cores of the two electric magnets. If you have wire of approximately No. 14 gage, use between 15 and 20 turns on the movable arm or an equivalent bulk of smaller wire.

The next step is to construct the imagnets. I se enough pieces #14 in, long to make a core about 35 m. in dismeter and wind with one layer of friction tape. Then wind on three or four amouth lavers of No. 33 cutton or alk moduled were The number of turns and the size of wire can be varied within rather wide limits and the device still will work perfectly Avoid many turns of very fine wire, however, if you intend to use the device on alternating current, as the increase in the number of turns will make the magnet. weaker instead of stronger.

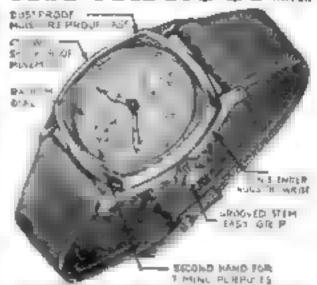
After you have wound the wire on each magnet, put up a couple of lavers of friction tape to protect the insulation. Then you can mount them on the base as shown in Fig. 2. They are clamped down by means of wire straps with a small wood screw through a loop bent in each end of each strap. This construction will allow you to change the position of each magnet with relation to the armature and so adjust the motion of the armature.

CLAMP the magnets lessely in place as the final aspistment must be made under operating conditions.

Now fit to the free end of the arm two sheet brass contacts as shown in Figs. 2. and S, and mount on the base two brass cortacts so placed that they will engage with the contacts on the arm. The sunplest way to mount each of the contacts. on the base is by means of a pair of round headed wood serews as shown in Fig. 2. Don't waste any time now in adjusting the spacing of the contacts as this, also, most be done after the system is set up and the current is turned on. you can, however, make oure that the contact on the arm is bent so that it will saide over the edge of the contact on the base in each cuse

Next mount six screws on the front edge of the base to act as building posts and you are ready to begin the installation and wiring. (Continued on page 10")





THEY MARKE INTERNAL "Epertament of the July of Strap Wart is for INDENS Went for NIDDE'S Went it in the resuperation will be to their pasters estapement interest process estapement with both the process estapement with both IT process for Pills as an Artist of the L.L. Follow Warters as a process of the L.L. Follow Warters as a process of the L.L. Follows was a superagnet of the process of the L.L. Follows was a superagnet of the process of the L.L. Warters was a process of the pro

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Home Wor'sshop

Automatic Block System

(Continued from page 108)

The electromagnetic switch can be placed wherever convenient, although it is destrable to have it near the signal tower to cut down the amount of wire needed to make connections. The tower for the red and green lights can be made up in any desired form. In the experimental aistallution shown in the illustration, air onl burned-out thermostatic control lower was used after all the mechanism had been removed except the red and green lights,

The section of the third rail that carries the current to the collector rollers on the locomutaves (marked O in the disgram) must be insulated at both ends by pulling out the connecting pairs. The instantes portion should be about three or four track sections in length or long enough so warn the current is cut off from this part of the track the oncoming train will not consticlear beyond it

Now study Fig. 4, which shows the way to bend the heavy wire contacts A and B.

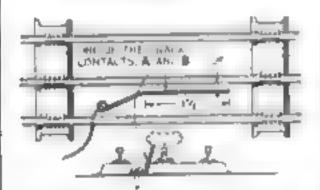


Fig. 4. Electric locomotives are made with double soller oullectors. One roller contacts with wire; the other nexts on the third sail

These should be bestened to the floor or a light wonden bourd under the track in such a way that the upper straight ser-Usy of each contact will be parallel to the Pard rail and about them. from it The straight sections of the contacts. which should be sightly higher than the third rad, must not touch either the third rail or the outside rails.

Use ord onry belt wire for all connections. No. 1 bounding post (Fig. 3) is connected to one were from each magnet, to one termonal of each of two lights and to the outsine track rail at the nearest point. The remaining wire from magnet D is connected to building post No. 2 and track contact A also is connected to this binding post. Contact Y is connected to handing post No. 3, and the remaining terms and of the green light and the insounted third rail O also are connected to this binding post

Cornect contact X and the remaining terminal of the red light to binding past No. 4. Connect the remaining wire from magnet C and the track contact B to handing post No. 5. Then run a flexible were from both of the contacts on the movable arm to banding post No. 6 and also connect this binding post to the third rail at any point except section O. This completes the installation and wiring and you are ready for a trul run and the

- {Continued on page 10%



The phone never rings for Jim

-perhaps it's comedones*

Time after time Jim answers the phone only to say, "Here, Walter, it's for you." And that's the way it is with everything so far as Jim is concerned. He's usually neglected - seldom counted in-often counted out. He never thought to blame it all on comedones

A great many young men suffer from comedones—commonly called blackheads. Skin can't be clean-looking, fresh, wholesome, if these disfiguring formations are present.

What's more, you may not even be conscious of comedoner. But your friends notice them. You may wonder why invitations become fewer-why friends—girls in particular—seem to avoid you. You may never guess. Perhaps it's coundoner.

Pompeian Massage Cream helps you overcome comedones. It gives you a clean, clear, ruddy complemen. It

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gets into the pores where comedones form, rolls out all ditt and only secretions, and stimulates a healthy circulation, keeping skin clean, pores open.

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After you shave, spread Pompeian Mansage Cream generously overyour face - and rad. Containe to rub unne the cream rolls out. Note how dark the cream looks That's the diff that was in your pores

Don't let comedones form. Use Pompeian Massage Cream every day especially when social or business engagements demand that you look your best. It means a hearthy, wholesome skin, It weens more joy in living

"WHAT ARE CONEDONES? promounced com's distant

Detrousey deposition. A small plan or main contrading the contractive due to a selection by word the fact more in which many less often called black-head.

Unt at Rome refere Showing

To get full plateress and benefit, use Princeton Massaga Cream regularly as himse after showing, Your face will feel and took like a muliom doilers for Jar at all drug stores.

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The Portugues Laboratories. Dept. 54 Cleveland, Ohio.

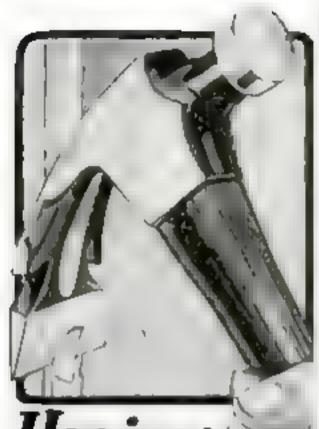
Gentlemen Lenelous 10c a dime, coin preferred) for a special itial tube of Pompeian manage tream.

Name SHAME Address

Cary

Scare .. .

adjustment



Hewing to the line is easy with this chisel-edge claw Hammer

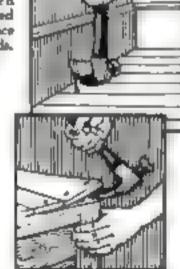
ERE is something new in hammers. The one-pound head of forged steel carefully tempered has a chuel-edge on the end of the claws. It is perfectly belanced and the two entra side claws makes it possible to pull nexts in close corners or next to the wall.

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Chisel-Edge Claw Hammer Company Hoboken, N. J. H. A. Ayvad

Automatic Block System

Continued from page 2: "

of the positions of the magnets and the contacts X and Y

Assuming that the arm is to the right so that contact Y is closed, you will note that the green light will be lighted and current will be supplied to section O of the third rail so that a trum traveling to the direction of the arrow will run arross section O without stopping. Just after it has left section (), the collector roller on the locomotive will strike contact B. and the current will flow through the windings of magnet C. The movable arm will be pulled over to break contact Y and close contact X. This will result in shutting off the green light and turning on the red light and at the same time the cur rent to third rail section O will be cut off A train following the first one will therefore stop when it runs onto section O. and it will remain standing in front of the red light in the signal tower until the first trum has traveled as far as contact A. when current will flow through the workings of magnet D. The movable arm will be pulled back into the first position. breaking contact X and again closing Y The light will change from red to green and current will flow to third mil section (), whereupon the second train will start up and continue around the track. The distance between contacts & and B will depend on the length of the trains you are running and the size of your track

TOU will find that the best adjustment for the magnets C and D and the contacts X and Y is such that the movable arm has the smallest possible movement that will completely break and make the contacts. If you get too little motion, both lights will have a tendency to stay lighted at the same time. and too great motion will prevent operation. The friction on the movable arm should be adjusted by setting the serew so that there is just enough friction to keep the arm in the position to which it is moved by the pull of the magnets

If a single train is operated around the track, nothing happens except that the signal tower lights change from green to red and back again each time the train passes the contacts A and B. The system will operate only for trains traveling in the direction of the arrow. If you can a train in the opposite direction, it will stop itself in section O and will remain there until the movable arm is reset by hand.

Block for Cracking Nuts

HEAVY hardwood block with nev-Aeral shallow boles bored in it is a help in cracking any large quantity of hard shell nuts. There should be a bole for butternuts, another for walnuts, and so on; in each instance the nut should project about one-third its length above the surface of the block. A sharp rap with a hammer on the end of the nut cracks the shell without acattering the



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own this combination and table and book trough! Bought in a super this end table would cost \$20 to \$25. If you make a yoursell it will cost you only 35 or so for the hardwood, and the finishing materials.

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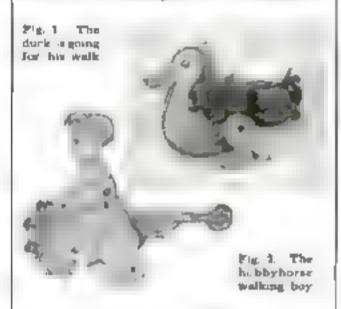
This seal up a radio, tool or oil burner advartisement significan the approval of the INSTITUTE OF STANDARDS. See page 4.

This Peanut Duck Walks Downhill

By George D. Hugo

NE sunny double-header afternoon I scarched between manage in my hag of penants for those of a certain shape and size a to as the slender result of my watch. fainess, carried home half a dozen selected roasts in my vest pocket. These were for the construction of a walking duck.

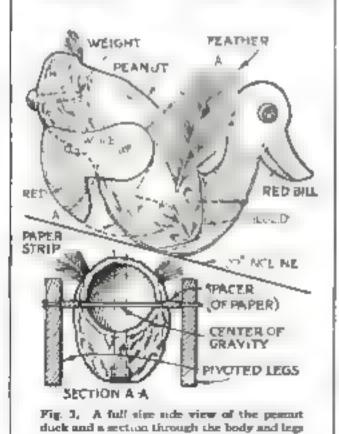
A neck was wanted by 1) that would waddle realistically down an archae-

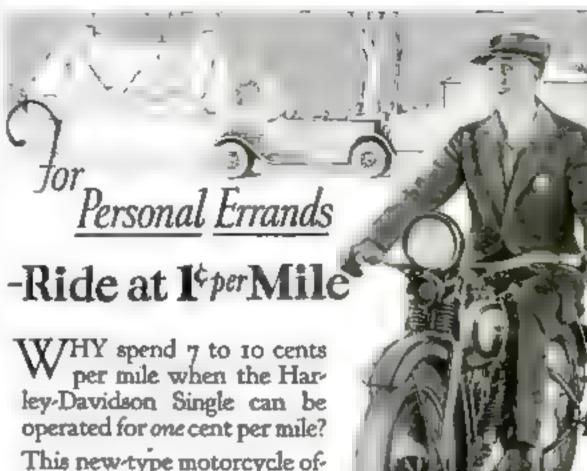


something to air ise the kindles and possably, those grown-ups who might happen. to see the toy in action. There is on the market a very popular wooden walk og toy that works on an ingenious bunning properties and it section that one regaltake the bherty of acapting this idea on a magual resense to a period novelly.

With peanuts of a promoning shape at hand less of er materials were neisted a of of In on thick enviloped (wallmourd), a couple of wire mass and a feather placked from an unsuspecting 31 10%

First to find the center of gravity of one of the peacute! For a while I did not think that (Continued on page 112)





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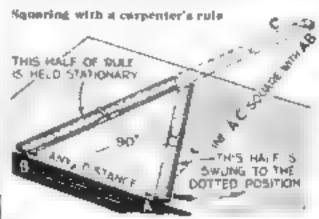
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meded in the small shop. It will handle north as out
with accuracy and pre-



SOUTH BEND LATHES [Signal Academics

How to Square a Board with a Folding Rule

WHEN no square is at hand, a car penter a two-foot folding rule may be used for drawing a bne squarely across a bound. Place the rule as illustrated with



the legs reparated any convenient disturce. Then hold the leg that touches B in its place and awing the other leg from Vas far as it will go. A line from V to C then will hent right angles to VB.—W. J. E.

This Peanut Duck Walks

(Continued from page 200)

particular peanut had any, but it was there, after all. Signtly above that point a hole was druled horizontally through the peanut for proofing the regs. Through this hole the classicle, if that a the right mine, was passed at a really a tima were not. On each end were mounted the coincid bottomed legs, which were ent from the wallboard as shown. To form loose-tube spacers between them and the body, tiny straps of paper were coated with glue and would around the paid.

Beneath the body the feet were conpected by means of a other had placed at the point indicated in the ende view thing 3. I as serves to lift the rear endof the body and causes, it to rod forwarupon its closet at a certain point in the dock's progress, so that the legs wilswing one step forward, abend of the center of gravity. Then, as the feet make contact with the ground, the heavier taiend lowers itself oids to be lifted again, by the resulted tig bar of the rolang feet. The movements continue with a smoothness and regularity that is ustoms on g.

The chest and tail aims the stride but to basance the duck property at was necessary to stok a beavy escatcheon proin the tail end as imbested in Fig. 3

The head and uses were cut from wallboard and glood in place. The joint was reinforced with a strip of paper. Finally the ming and tax feathers were added and the toy was parted.

The other novelty illustrated in Fig. 2 works or the same principle, but both hody and legs were ent from wallhoard. The pivot pin—just an ordinary sewing pin—has a bit of paper wrapped around it on each sair of the basis to serve as spacing sleeves similar to those used in the diak. A second pin passes through the box's feet and keeps them the proper distance apart. Another is pressed into the horse's body as shown, to regulate the stude it stops the swing of the second pin of the completion of each step.

How to Utilize a Cellar

(Cantinued from page \$2)

and later potted to be transplanted into the open ground when the season is suitable. Moreover, these plants can gradually be made hardy so that they will not stop growing, as many greenhouse plants do when set in the open ground, and therefore, they will be in bloom weeks before the ordinary bothouse-grown plants. This factor will be attractive to a gardener living in a locality where cold nights continue rather late in the spring.

It is advisable for any one who wishes to have a frame to fit up a small shop in the openent so that he may make his own trays. The writer has done all the work of building and maintaining his frame in his own little shap and is also able, because of having the shop, to make usury meful articles for the bouse and garden

Bender the economic ride of this verture—it manres a saving in florists' bills many enjoyable hours can be spent in this most wholesome recreation. The writer has found that his own little girl would rather spend her play hoors with lem in the basement than with her toys upstairs. I play mock in the cellar will be greatly enjoyed by any claid.

How I Remodeled the Cellar of an Old-Fashloned House

By Mas. A. E. H. Carswicks Harrie, Ont. Canada

MIE front resing of our twelve-goom Thouse and never had the floor cemented. It was constantly things and somet mes flooded in the spring. This had destrived the lower bricks of four brick pillars supporting the center beam under too main floor and consequently the whole house had mark in the center

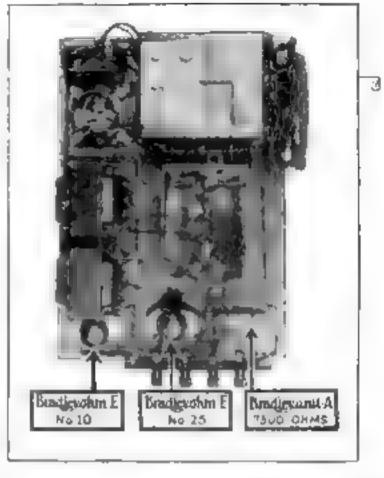
To support the beams, I had a cement paristion made, allowing for two doorways. The floor of the whole cellar was tited and dramed into a trap. A partition of plaster wallboard then was built to d wire half the cellar in two. This gave a · g launstry and a large atoreroom, each with a window.

The other half of the cellar, with the formace in it, was objectionably dusts. Using & by & m. studding. I mailed a street across the bottom of the main Boor joists. along one side of the furnare hole. Their with a plumb bob. I found the exact line below it to lay another length on the floor Between these I fitted 2 by 2 in apprights, spacing them 16 m. from center to center, Two more study were no lest to adjacent sides of the corner pieces to strengthen the corner and provide support for the

I nailed the wallboard on to make a close wall and thus confined the dust entirely to the furnace room and the 14-ton coal but. Plaster of Paris mixed with flour paste an that it would not set queckly was used to fill all joints and cracks,

The nading was done with a shoemaker s hammer, as it seemed to be well balanced and the big, flat head did not dinge the waliboard. The (Continued on page 126)





What a whale of a difference a few Bradleyohms make —in a B-Eliminator!



Bradleyohm-E

For Boliminator arrake tequiring wide valtage control. Bradlevolm E in meet al. It is an overtite Bradlevolm with notice at capacity to headle all permal B cursime. and the Bridleyolas Ein the checkered certon. Yout



Bradleyunit-A

This wolld, malded, Sund remeter has no game or her-metic semina in its construc-tion. It is a need unit to in after plated end care that are not affected by temperature, molarure and sea, fly all menus, use Bradley noit. A schen you much a famility markers.

MAGAZINES and newspapers have been publishing circuits and instructions for swembling B-eliminators, Many types of kits have been used, but the outstanding feature has been the almost unanimous recommendation to use Bradleyohm-E for plate voltage control and Bradieyunit-A for the fixed resistor.

The leading manufacturers of B-eliminators have long since adopted Allen-Bradley variable and fixed resistors as standard equipment for their B-eliminators, In fact, the Bradleyohm-E has become almost as universally used in Raytheon tube B-eliminators as the Raytheon tube itself. The scientifically-treated graphits discs in these remarkable units have never been equaled for rilent, stepless plate voltage control so essential for the satisfactory operation of a radio set with a B-eliminator.

When you build your B-eliminator, always insist that Bradleyohm-E and Bradleyunit-A are included with kit. You then will be amured of perfact voltage control. Send for folder "How to Build a B-eliminator" describing seven popular hookups,

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How I Remodeled a Cellar

((entertail from page (71))

sawing was done with a pruning saw, The fine teeth I found good for starting a cut and the big teeth for doing the work quickly. For the door, I used a well-battened storm door.

This left me with one quarter of the ceilar still to be used. In that I installed a workshop, as I have been buying Popular. SCHENCE MONTHLY for some months and had become properly enthused with the destrability of having a place for tankering. I made a workbench and on the back board fastened a length of metal lusoleum binding with large-headed roofing nails, to provide holders for some of the tools,

A wooden vise was made, a metal vise purchased, and half of a butt hinge screwed to the beach near the left end of the top. to form a stop for work being planted. A tea box filled with eigarette boxes makes a fine calanet for small articles. Three rasun boxes, one above the other, with three pieces joining the miles so that they can be pulled out ustil all are incovered. and a piece on the back for a leg, serve as a handy tool chest.

In this little shop I have repaired several clumes, done over a walnut table, a walnut seleboard and much other work.

It present having attended a motor mechanics class two mights a week for several months. I am getting my car pilo

Further plans for the cellur are to lay a floor of rock curpet 7 by 15 ft, in my workshop and to build a great set of shelving. I also intend to cut off one end of the storeroom with another wallboard partition and run the water service pipes back and forth many times across the ceiling before they go up to the taps. The fresh. cold water will keep the pipes cool and make it a cold storage room. It will have shelving added, of course, and hooks for provisions

Dust Chute from Kitchen to Cellar Saves Footsteps

By IRVIN RITTENHOUSE Point Pleasant, N. I.

HERE is an idea for utilizing a small space in a cellar that will save the housewife much work. I placed it in thy house. A budder saw it. He has placed it in several bouses he has surce built

While most up-to-date housewaves have a vacuum cleaner, brooms are still much used, especially in a kitchen. To channate the dustpan and receptacles for catching sweepings, cut an opening in the kitchen floor between two joists near the wall. Make a hinged drop door flush with the floor, with a flush ring pull. Place the lunged side, if possible, so near the wall that the door will not remam open except when held up with one foot while the sweepings are being beushed into it. Thus will manne the drop always being closed when not in use.

From the opening in the floor, build a straight. (Continued on page 115)





150,000 in delb

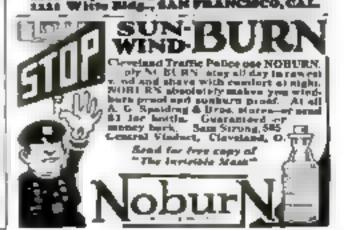
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Dust Chute to Cellar

Continued from page 12.8]

square chute of any light wood to reach abuset down to the top of a sugar or flour barrel. Tack canvas or other cloth to the chote so that it will hang down over the barrel and prevent dust from getting into the cellar

To save stooping to lift the trap, a stock or rod with a hook attached to it may be kept hanging on the wall near by

How to Partition Off a Cold Room in a Cellar Corner

By DANIEL SMILEY, JR. Mohonk Lake, N Y

ESIDES the regular coal bina, wood D boxes, trash barrels and furnace, we have a carpenter's bench and warkshop. scanar to that described in the April 1860s. of POPULAR SCIENCE MONTHLY. One of the more musual features is a cold cellar. a convenience almost always found in the old country houses, but, I think, very

seldom in modern houses,

It is partitioned from the main cellar by \$ by 4 in, studding and regular wooden aid ag. The north corner is used so that the cement wall keeps it cool on two sules. On the aiding we placed ordi mey paper, but now one can get much better madaling material charge. This nateria, also should be placed on the lower sale of the first floor beams. The smaller the wandow or windows opening into the cold room, the better. The unterior in whitewashed.

tnother feature of our cellar is a hathroom with a large shower bath for

the use of workmen.

Small Brooder House Built **Outside Cellar Window**

By A. K. KIMBLE Marion, Kant.

REVERSED three windows on one I side of my cellar so that they swing outward and then from some old package cases built a platform 3 by 0 ft. level with the windows. This was to serve as the floor of a small brooder house, Sides were erected and a hinged back put on. The Hoor was so arranged that it could be taken not for cleaning.

In front of the windows I built a small pen. As the furnace room is always warm, this arrangement makes an ideal brooder

house for small cheks.

Builde a Band Saw Cheaply

TT MAY interest you to know that I A have just completed one of the ballbearing band saws designed by Mr. Ray P. Kuns and described in the February INSUE OF POPULAR SCIENCE MORTELY. The saw works perfectly and was made at a cost of \$25.77. A saw of the same size, if purchased in the ordinary way, costs \$75.-H.S.M., Venzie, Me.





The married and recognite come The numerous events com-piled of case Log Bob worth for go to FRFE to her y act of three Architect for Deat Post Deat Board in teat of, translate. Moreous Locket with embraced cover acts every Loured States and Loundint Radictors States of moral Jone sat, using power of attraction of moral by all leaves would states and call legaco, wavelengths and heatons. Also polades the principal foreign statists. Adyour dealer to

THE new improved Anstocrat Vernier Port Dial at une of the great dual values on the market. Despite its many outstanding advantages, the Aristocrat costs no more than ordinary vernier dials.

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The Shipshape

The Expert's Way of Repairing a Shingled Roof

By A. E. LLLING

HAE you ever watched a carpenter neatly and speedily indaying length patches of new shingles in an old roof and said to yourself: 'I wish I knew the trick of doing that so that I could fix those leaks in my own house. 3. It isn't really hard. you can do just as antisfactory, if not so rapal a job as an expert shooger.

in repairing a roof it is of primary importance to ascertain the spots where the leaks originate. That sometimes is the most difficult part of the task. It often calls for careful sleathing in the attic with faint water marks for clues.

A leak may be found quite a distance. from the defocute run stance on the ced-

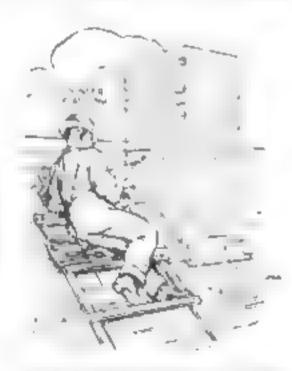


Fig. 1. Completing repeirs around a chimsay by committing country dealing in place

ing and walls of the room beneath. At times run water will follow down a rafter. or roof buard a long way before leaking into the house. The attic right under the daugles attends the best information.

When the leak or leaks have been traced, push a thin wire finishing and up through the shingles to indicate on the out-nic where the patching must be done.

If it is not possible to examine the undersale of the roof and the outside alone must be the guide, look the shargles over carefady just above where the leak shows in the room below. The strugles may appear to be sound there in that case. search higher up wherever it seems likely that the rafters or heards may carry water down after it has penetrated beneath the slungles.

The first thing you will ask when you Continue Lon page 219 come to under-



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M 20T interesting coing you ever did a face matches not quive holds for any fines or only whose you have been marked and constitutes. In the day fly attent Madels are accurate a quies of the land to inher have part a sing fit may be big much sen. They are guarant could so by at the air warm correctly constituted.



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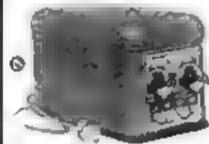
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Thirshape Home

Repairing a Shingled Roof

(Continual from page 114)

inke the repairs, is: "How shall I get up and work on the roof?"

An iron roof hook, which goes over the raige, may be obtained at many hardware stores. This is fastened at the end of a light ladder, which is pushed up on the roof until the book drops over the rulge. In place of a ladder, a long board with evenly-spaced elects may be used.

Another method is to nail a sound I by 2 m. shingle lath (these commonly come in lengths of 12, 14 and 16 ft.) on to the hutts of the shingles so that an eightpenny nail will go through into the shargle lath below. Do not nerve the nanhends right in , let the heads project so that they can be gripped and drawn out easily

Laths made in the form of a ladder, only wider than usual, may be used as illustrated in Fig. 1 Drive about four nada in the roof to hold this support in place. When these or any other units are withdrawn from the roof, each of the holes should be stopped with roof cement.

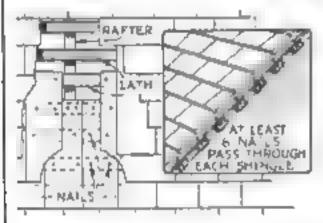


Fig. 2. How shingles are leid. Each not ordinarily passes through three changles

If the pails have been driven into but not entirely through the alongle lath (and not right through the shingles into the attic) there is little danger that a leak will develop, even when no roofing cement is used, but it pays to be on the sale ande.

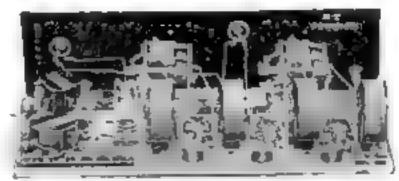
Shingles may be bought by the bundle from any retail lumber dealer. There are between 200 and 250 shingles in a bindle The lengths are uniform and should be 18 or for roof strengles and 10 m. for wall shingles. The widths, however, are random and vary considerably. Shingle nada, preferably fourpenny in use, are used for fastening the shingles.

Be sure to have on hand heavy tar paper, a tarpanian or something of the and to close up the opening in the roof quickly in case of a sudden storm.

One of the simplest types of repair is when there is a crack through two showgles, one right above the other. This may be mended by pushing strips of painted roofing tan about 7 in. long up under the shingles. If the strips are put in the full distance, they will, in effect, overlap each other and shed the min.

If the shingles are too far gone and one or more new shangles must be inserted, remove the old shingles by splitting them up with a batchet or chosel. Rammer them into small pieces and no trouble ((ontained on page 116) will be found in

Take Advantage of the New Power Tubes with the New Power-Six Kit



The New Bremer-Tully Power-Six is a revision of the famous Counterphase Circuit to take advantage of the latest improvements in tubes, resistances and parts.

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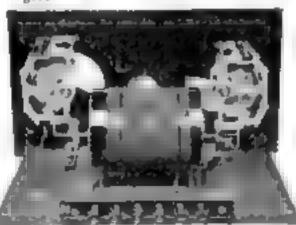
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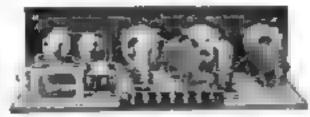
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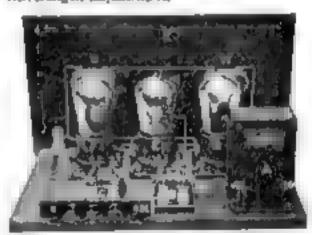
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Describes a simple, one-tube regenerative receiver of the fixed coil type. The regeneroting is controlled by a variable condenser and does not affect the wavelength adjustment. Quality of reproduction is excellent because no audio frequency current flows through the ticker coil. The coil is hand wound and the rest of the parts can be of any standard make.



Four Tube Radio Receiver Blueprint No. 43-Price, 25 cents

Describes a four-tube radio receiver consisting of one stage of radio frequency amphilication, a regenerative detector, and two stages of transformer coupled godio amphication. It gives the greatest power for distance and volume that is obtaing, lefrom four tubes - masy to but d, uses any standard parts except the coils, which are sample to wind by hand. Two control tening and regeneration does not affect wavelength adjustment,



Three-Stage Amplifier Blueprint No. 42-Price, 25 cents

Describes a three-stage audio amphier to be added to one tube set of No. 41 to obtain loudspeaker results. Is equally useful with any other standard one-tube detector curcuit. Consists of one stage of transformer coupling, followed by two stages of resistance coupling. Volume control is simple and does not affect quality of reproduction. This blueprint does not describe a radio receiver -it is simply an audio amplifier to be used in connection with a one-tabe radio re-

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Me China Lang

Repairing a Shingled Roof

(Continued from page 213)

taking them out quickly, bit by bit. Before the new alringles can be placed, however, the old nails must be removed. By examining Fig. 2, it will be seen that at least six mails have had a grip on each shingle; wide shingles have more. Four or more of these nads must be either broken off, bent over and flattened down, or drawn out. A tool used by slate roofers and known as a upper will serve to deaw them out, no matter how far they are hidden, but it is not a tool easily obtained. Many carpenters also carry long, thin, narrow saws tempered to cut raids in repair jobs of all sorts, when these path cannot be reached otherwise.

THE work can be done with a thin pry-har or a long, thus prying chosel. Drive it up against the noils to break them off or heist them over and flatten them. In recovering old shingles to make a patch, break out the top ones first, and the others will come easily. In breaking out the old shingles be sore to have overlapping pieces so that no two of the new joints will come one above another

Fig. I shows the method of alonging and you can see just what to do, in any case, by observing the way the original shoulds were laid.

Begin at the bottom of the patch with the new shoughes and use regular sloughe mals for all the lower courses, but go vanged or copper mals for surface unding at the top. Some surface unding must be done in repair work.

Water often gets in around chimneys and walls because of rusty or defective of flashings. The flashings are strips of two, copper or other sheet metal which are laid against the brick and go under each

land against the brick and go under each shingle as it is placed. A penkinfe point pushed down on the flashing, especially if it is of painted tip, will often disclose that it has been nearly destroyed by rust.

TO MAKE a good repair, take up a narrow stap of shingles, put down new flashing and replace the old shingles or put on new

The flashings, if of the should be well painted on both sides and allowed to dry before being used. They should be about 6 by 8 in and are bent and applied as shown in Fig. 1. One is placed under the end shingle of each course as it is laid, so that the flashings overlap each other Except on the cluminey or wall aide, they are hidden from view when laid.

As shown in Fig. 1, the mortar is racked out from between the brocks where necessary and the counter flashing is turned in about 47 in. This metal is fastened in the joints with wall hooks or tenpency hads and the cracks are filled with lead or elastic roofing rement.

Standard roofing cements alone will often make a serviceable repair over unperfect flashings at chimney or walls. They must be applied when the roof and walls are clean and dry

We now come to what is the most difficult repair on a fontaned on page 11.)



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Mirchard Home

Repairing a Shingled Roof

(Consumpt from page 138)

roof-when a leak is found down the valleys. A valley is an angle or gutter formed by the meeting of two rout slopes and usually is laid with a continuous onepiece strip of painted tin or other sheet metal from top to bottom.

By pressing a sharp point against where shingles and flashing meet, you can tell if the metal has been eaten through. Remove and carefully store the stongles if they are sound enough to be replaced. In any case, keep one to show the angle cut. Note, too, just how they were originally last. Have a tingrath lay a new flashing down the valley. A chalk line then may he orawn from top to bottom as a guale in relaying the slongers so that a work truttime job may be done. This work requires some cure and patience and should not be attempted before practicing on straight patches.

All other shingling repairs on roofs or walls can be accumplished by observing these auggestions and studying the method used in the old work that is to

Protecting Water Pipes

be replaced.

THE average bouse in localities. where the winters. are severe to "grant

business" for the plamber and an amore ance to the householder unless the water piper are well protected from Jack Frost. Wherever water payer are exposed to the extreme cold, freezing is movimile.

My experience in having expensive repairs made during several winters ledme to device the following remedy which cost less than a dollar for materials. I see it every winter and have yet to see it ful to safeguard the water piper although the outside temperature sometimes goes ns low as twenty degrees below zero

At the point where the piper are likely to freeze, which in my house was usually at the water meter. I built a housing of sheet metal so as to unless as much of the prompt as possible. A small gas plate hurner was placed under the popes; a good oil lamp would have served the same purpose. The gas plate is turned on only enough to keep it burning, yet this is sufficient to host the water at a temperature above the freezing point. On esperially cost nights, as an additional precaution, the water a allowed to dep from openy two famets, so that it will be kept in motion, "H. J. Blakks, M.D.

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WHEN I was called upon to repair a chiminey on a twostory house not

long ago, I found it dangerous to walk on the slanting mof with my leather-soled shoes. By cutting two pieces about 614. ay, long from an old 4-m, mner tube and slipping them over my aboes. I was able to walk anywhere on the roof without supping. If a pair of rubbers is at hand, they will serve the same purpose. - MATT J HEFT:

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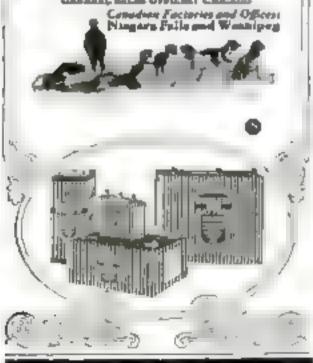
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Miter around the edges a narrow panel molding. The type of molding will depend somewhat upon the style and construction of the door house tomber dealer will have something that will serve,

Before applying the molding paint the outside surface and also the aids that is to go against the glass.

On doors of other types, such as those having five panels, lay out pened lines on the stries and on the upper and lower rada as a goale for applying a rabbeted molding. Nail on the lower piece and one aide. set the mirror in place and just on the other two strips.—Lowin M. Lovie.

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located under the window. On windy aights a cold breeze is apt to blow through the cracks on the bather. To shut out this draft in one such bathroom, a removable screen was made of closely woven

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It is unnecessary to use back gears when turning or milling brass, copper and other soft metals, except perhaps for the removal of hard scale on brass custings; after the scale is removed, finish the job on open belt speeds.

Every man should try to give himself a square deal-and give the shop one,

If you were caught on the roof of a burning building, would you jump down or try to find a safer way? Then why jump to conclusions when you have a tough shop problem to solve?

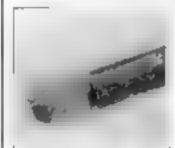
It is well to be sure that you are right, but it is not right to think that everybody else is wrong.

When filing work keep your file clean: if an ordinary his brush will not readily remove the small bits of metal that stick in the teeth, a piece of flat copperor brass will take them off.

Get down to business and get ahead of your luck.

There is no safe way to cover up or disguise a "buil"; lives are often endangered by faulty construction.

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CTOCK ROOM men in shops and supply stores will appreciate the rober shown It is for movens pipes about, cape coally in narrow andes. It is merely an tron roller. held in a sheet

from frame. It is inserted in the end of the pape, which is pushed along smoothly over the floor instead of being dragged.-NORMAN MOORE.

It often occurs that a piece of work is pulled off a demagneturer and the current is left on unnoticed. This is harmful and costly. It can be avoided by matelling a pilot warning light on the wall between the awitch and the instrument. - H J C



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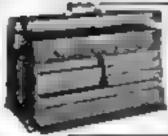
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Fig. 194 A. Spright its Sugargers and State of Science n - de neue actes de com-

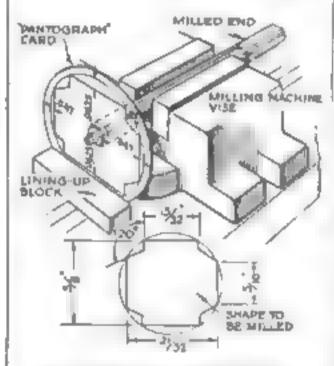


"Pantograph" Card Aids in Milling

By HENRY SIMON

MILLING a rod to an odd cross sec-tion, such as abown below, is not so hard when the proper equipment is at hand to do it with, but presents great difficulties when, as is more often the case, If must be done on a plant miller with only un ordinary vise. To hold several surfaces parallel or at specified angles to each other while staying, at the same time, within specified dimensions, is extremely hard. That is because there is no good way of checking accurately the position of the surfaces as the work progresses,

A satisfactory method of solving this problem is to use a modified pantograph. method. On a disk of stiff bristol board, the cross section is drawn excefully on a large scale, say ten to one. The disk is fastened directly to the end of the rod to



A card bearing a greatly enlarged profile is used for setting the work accurately

be milled by means of a screw and a washer. In some instances it may be precessary to leave the rod longer for this purpose and cut it off after the miling is done, but in a good many cases an existing center may be used as a seat for the screw.

The assembly is placed in the miller vise as illustrated, the work being blocked up until the disk misses the table. The first surface it is desired to mill is liged up parallel with the table by means of one or more size blocks or parallels. Then the cut is made and the work haed up in the next position. By repeating the process, completely finishing each cut before the next is taken, the parallels and angles are reproduced furthfully on the work within very close limits.

If the drawing is ten to one in scale and is lined up each time to within only 🍇 📖 . the corresponding surfaces on the work will be within less than ,002 in, of their true angular position.

In order to hold the various dimensions within close limits, the use of a dial test indicator is advisable. The indicator is clamped to some (Continued on page 191)

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Set up range to atta, enter or land. Put builded after builded thereugh mome tode. Proved to attain order or new data presente to the property of the total order of the start of

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Get Xmas Crasmon Now Ger Arras Crosman Property Remarkable of the vinte family Ask of a decire. She equival supply the early a set of flacated minimum has 52 or 1988 area of training the 52 or 1988 area of training to 12 to 1988 area of 22 decired before a 15 had attachment to 48 paper targets for per straining coupled for write to the followating bootslet and laste to the followating the second control of the followating the followating

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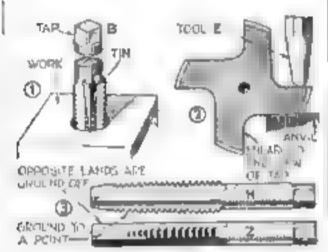
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Detter Shop Fethods

Kinks That Have Helped Me in Tapping Jobs

SOMETIMES a hole, tapped with a worn tap, is too small. A track useful in such an emergency is to ship a cut piece. of tin over one land of the tap B as shown in Fig. 1 and re-tap the hole. Another method of making a tap cut larger is to nuncal the tap and awedge or special just under the teeth with the tool E. Fig 2 This method sometimes is used to give a



Emergency managing for making a worn tap cut large on improvined left bond top

Inpelearance. The lap should be re-hardcard and tempered

In Fig. 3 is shown a treatment that makes possible the tapping of a left-hand thread with a right-hand tap. Two of the muds are ground flat, as at H, the other two are ground very thin, especially the ectors ig teet i as at Z. By careful minusthat and the tap will not an acceptable. If the aid thread we enther is no time to make a proper tap. Chambes Kuchkill

"Pantograph" Card for Milling

of automised from page 1399.

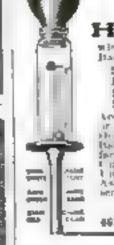
projection on the macque bed where it can be made to register by hitae vertical and transverse movements of the table As an aid in this work, the differencerepresenting the required number of thorounds of each cat from the periphery of the work to the finished surface are marked on the pantograph drawing as shown. If this is none, the work can be united rapidly to within close limits both as to angles and date issues.

One necessary es notion is, of course, that there he enough of a true surface on the work to take hold of tagain evenly each time it is reservableough it is not necessary that it is ways be a rod as in the illustration. Work of a general square. Lexagon or other polygonal er sa section can be handled, provided only it be long er righ. This is accomplished by custing a habbitt sleeve around the portion to be held in the vise, and furring it on certies. if the work cannot otherwise be safely clamped. Such a case is where angles on the milled part must be at odd angles to the surfaces of the piece.

Work varying in length from a few in hes to several feet can be handled in this manner. For very long work an additional support should be clamped to the maler table near the disk.

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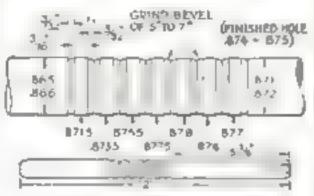
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Burnishing Broach for Bronze Bushings

ARGE manufacturers recognize the finishing holes. It is a tool that deserves a place in the jobbing or repair shop. The microthke finish it leaves is of superior quality; the cost of the tool is less than that of the corresponding reamer, and the time for finishing is reduced.

The tool is similar to a cutting broach except that the teeth are smooth and usually closer together, as there are no chips. The finish of the teeth must be the best attainable. The illustration shows a deagn that was successfully used to finish front axle bushings after assem-



A tool used for denshing and bushings. Note the denominate of the various torpic

The breach is forced through the work with an artor press.

The entering cost of the heuseli is enough smaller than the hoje to go in the un-sized bushing. From the entering end the lands aperease progressively in size to the last three feeth. Then two are the some size, and the last it slightly smaller.

It will be noticed that the drawing calls for final teeth larger than the finished hole should be. This is because the metal of the hushing will "come back" to some extent after the broach has been forced through it, and also to permit the last teeth to be stoned down to make the hole fit the gage. Were the teeth to be made the exact size at first, the hole might be too small and the broach could not be enlarged.

The tool is made either of carbon or high speed steet. It is rough turned hardened and ground to size. Then it is lapped to final dimensions by working the lap back and forth over the teeth. Tallow or grease may be used as a labracant with it, if desired H. L. Wheeligh

An Extension Die Holder

TN A shop doing general work a die A holder was required in a hurry to

thread some autospring claps. An magnative mechange rescued a Ford front wheel bub from the scrap pile, cut the flange off. and put in a set sever and a banthe This just fitted the dies used. -G. D. H190



Die holder made Irous, on old auto wheel hub



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If it, dight take your was home, in the Path-Rades. Two is alter applied with his step i traces, has less relating experient possible property, by the little process who made a state or return the step is a large with the little little process. The step is a large with the little l

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Read Interesting article on Page 4. "How \$100 a Month. Invested Properly, Can Make You Independent."

Better Shop Methods

Tin Sketch Board for Rough Use in Shop



The drawing paper is fustened with wire paper supe to a strap sheet of heavy too

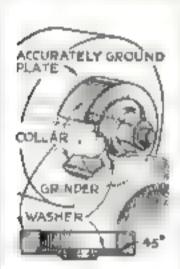
MOST practical sketch board for rough ship use is a piece of smooth bright, leavy tip. The paper is held finds to purce with four common wire paper eleps. The tor and claps are cust to ob an The expense a triffing compared to the firsting of a wooden board.

The writer passione shop aketching and travery for a primiter of years, and is willing to match this bound " with my thing for a approals of multiday, and price-TREES - BRANK BENTLEY

Beveled Washer Is Help in Grinding Collars Parallel

"TRINDING pulling machine collars O necestrately parallel often as not the easy task it seems. To bundle this work efficiently the writer devised a method that is giving except unails good results.

One face of the collar is ground at the same so big with the hore. A besel s ground or the opposite side of the collar



Coller in position for grinding second face

to take a washer made as shown in the accompany og Hustra tion The colar is clamped with its finished side pgainst proposition rately ground plate by means of a rod through the spandle.

The accord face of the collar then is ground with a cup or somer wheel O S. Marshall.

Dust Groove Protects Threads on Spindle of Lathe

DIRT chips and that will callect in the internal threads of faceplates and

checks so that when they are screwed on the smalle nose, some wear and rutting occurs. To prevent thus, a groove may be filed into the аринdle ак sless F \ (



Dust and chips are collected in the groove

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First enclosed. Entere unit enclosed in heautiful mer - Are, with hanged cover and hangle

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FREDRY JULIE SPECIAL

How to Fit Machine Keys

Cantoward from page 73:

After the key has been fitted perfectly, smear a little oil on its faces before driving it home; you'll be thankful if you vourself happen to be the one to remove at later on.

Woodruff keys are much used by machine-tool builders and automobile manufacturers. They should fit reasonably tight on their aides with a minimum of clearance top and bottom. The key ways for this type of key are milled with special cutters for each size of key. The standard depth of the cut is gaged by the diameter of the shank; in other words, the cutter is mak in until the shank just touches the shaft.

THESE keys are usually made of cold rolled steel and require very little fitting. They are sometimes awented into their seats to make a very solid job. This is done by tinning the key, heating the shaft slightly in the region of the key seat, and placing the key in its seat To tru the key it must be polished all over. Dip it first in the acid, then in melted solder, and allow it to cool. The shaft may be heated with a blowtorch or any other convenient means, preferably in a gas or oil furnace as a conffire is apt to leave a deposit in the keyway.

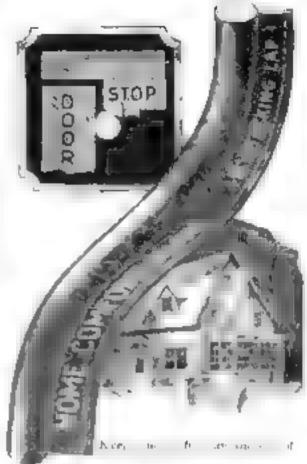
When fitting any kind of a key it is important to keep the corners well rounded and the ends beveled, and be certain that the bearing is on the flat surfaces and not on the corners. The beyeled ends prevent the key from upsetting while it is being driven and also make it easier to remove. If a key bears the least bit on any of its corners it may cause a false bearing, in which event it will loosen up quickly in service. In driving a key home it is best to use a "set or block between the key and the hammer. Direct blows from a heavy hammer may cause the key to swell and stick hard in its wat so that removal will be extremely difficult

KEYS are often stubborn things to ex-tract and it is sometimes necessary to resort to heating or drilling. A badly stock key may be dealt with by heat and banquering and the liberal use of kerosens. A good but torch flame played over the outer surface of the keyway often will help. Kerosess should be squarted into any small crevice with an oiler to dissolve the rust. Peening with a ball peen hammer directly over the keysent also will help to start an obstinate

Key drivers can be made out of good cheel steel, drawing the body out into a long, rectangular-shaped punch and tempering it about the same as a cold chisel. The tools should fit loosely in the keyways and be ground off perfectly square on their fore ends. Small sizes can be made out of drill rods. Pinch bars and wrecking bars, wedges and taper chards also are useful in removing keys. that reast ordinary efforts to remove them.

When a gib

(Continued on page 127)



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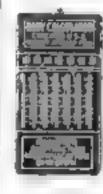
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Better Shop Methods

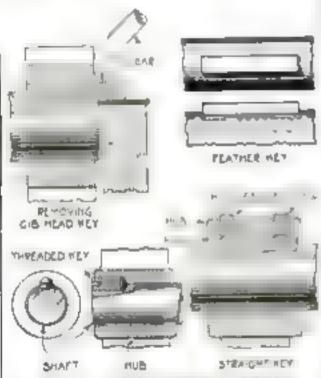
How to Fit Machine Keys

Lantinuet from page 144.

key is used on the end of a shaft, as in the case of a flywheel, the projecting head should be covered with a hub cap to prevent seedents. In prying out such a key, it is well to support it on the under side with a jack or block of wood. That prevents the key from bending under the strain of the lever

The last resort, if a key resists all other ways of removal, is to drill and tap a hole in the end for a bolt or stud. The bult will serve as a jack in conjunction with a strap and block placed against the suaft or hab. By tightening the nut and harmering lightly against the bolt at the same time, the key ordinarily will respond.

A hole may be drilled the whole length f the key, if necessary. This weakens is hold. By tapping part way in for a bolt or stud, the key generally can be removed.



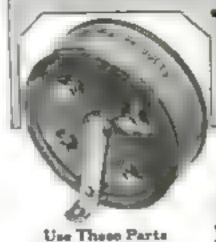
Removing a gib key straight and feather beyon a threaden key for experimental work

it also can be orashed aideways toward the conter with a cape chirel. A pull on the built or stud is then generally sufficient to withdraw it.

Often when repairing or overhauling machinery away from the home shop, keys will attek in spite of all one can do. A square key sometimes can be removed, f a driver is not available, by using a pair of na i pincers, the sharp paws of which are closed into make made in the side of the key with a sharp cold chisel.

A key sometimes used in light experimental work is the threaded screw partured in the illustration above. This not only acts as a key but also holds the gear or pulley at a registered position on the shaft. After the machine has been taken apart for repairs or to make changes, a gear to keyed always can be restored to exactly the same lateral position, as the threads must line up before the key can be unserted.

Fitting keys brings to mind the actual case of Tony, a new machinist in my old shop. Machinists were scarce at the time, and although Old Bill, the foreman, had his (Continued on page 1 5



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Transactor cut 1 08 Variates 150 Co. e Uni each 1 50

-factor too too a

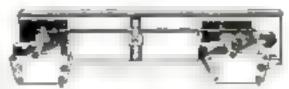
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Better Shop Methoda

How to Fit Machine Keys

doubts as to Tony's shility, he nevertheless gave him a chance to make good and put him to work fitting keys on a big machinery job. Tony worked half a day unobserved, but after the lunch bour Old Bill gave him the once over from behind a big easting.

The key upon which Tony was then working had been made undersize and the gear did not tighten up when shipped on to the key. Slyly taking his pocketkoife, he cut several paper shims from a newspaper to place under the loose key Old Bill then descended upon him and headed him abruptly for the paymester's window.

"THINK about six inches shead of your work." was the advice given us young fellows one day years ago by Old Bill. He, strange to say, really practiced what he preached. Here is how he applied it to his work when fitting machine

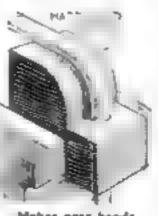
He cut off a piece of stock to make a key a few inches longer than necessary A cut or two over one side in the shaper brought the key to the approximate size. with the peressary taper of by in, to a foot. Shipping it into the keyway until it bottomed, Old Bill had his rue mark for cutting off the projecting ends. And while other mechanics were taking fine cuts and filing their heads off to make a fit and trying their best not to get their keys undersize, Bill just loafed along, never appearing to hurry, and yet beat them every time. Compare his method, which involved only the loss of a few ounces of steel, with the time commining fit-and-try efforts of less skilful machinesta.

"Lock your power grip with a key well fitted and he proud of your job," is a motto often quoted by Old Bill, who knows how to fit keys properly.

If you are a regular reader of this department, you are femiliar with the exploits of the machine shop foreman known as "Old Bill" Joe V Romig. who wrote this article on keys, was one of many fine machinists who learned their trade under Old Bill's kindly guidance. The article, it might be added, has just come to light among some old papers; it was written by Mr. Romiff in 1922 shortly before his death and represents his last work for Populan SCHENCK MONTHLY.

Block for Bending Tubing

ARAGE med J and others who have to bend brass or couper tubing will find the bluck shown an and in tuening out good-looking work The hole is about 1/4 in larger than the tube. The block can be held up n vise, or by hand. -- H. L. W.



Makes oner bends



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Popular Science Monthly



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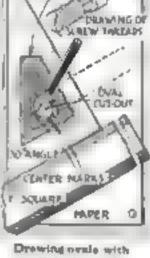
Repeating Odd Shapes on a Shop Drawing

THE accurate repetrtion of an odd or irregular shape in a drawing, if required many times, is frequently a difficult and bresome job. In isometric work, the re-drawing in accurate alignment of the same ellipse representing the section of a shaft or a hole, often among a maxe of other lines, is one of those things that take the joy out of life. That is especially true when the work is small. The many construction lines run close together through other permanent and temporary lines and are interspersed with dozens of produces made by the compass,

All these troubles can be avoided by means of the sample method illustrated It consists in making a templet from

paper-thin cellulord and using it stretched over the bale in one of the regular transles. Blank camera film is just right for this suffered and can usually he had for

Vdrawing of the required shape at first usuale somewhere on the board, and the prece of film tacked over it. Next, necessary center lines are drawn on the film so that they will



a colluland templet

he plandy vanids when the templet is firmshed.

The drawing is scored on the film with d videes or kinfe, depending upon its character. An elopse such as that slown in the drawing for instance, is hest made with a bose divider, and it is preferable to go over each are several times instead of trying to score the full depth at one cut. Other shapes can be made with a knife and French curve, and in Dist case a single cut will be enough

When the acornig is done, it will be found that by bending the film, the core can be broken out clean. The border of celluloid is triumed to leave about 14 m. margin for overlapping on at least two sides of the bole in the triangle on which it is to be used. It is stuck on with a couple of dauba of labrary paste.

When the job is done, the templet can be palled off and preserved for future use. After a number of such templets have been maste, the draftsman often will find that he can use one of these for some new job he has to do.

berew threads, cod springs, multiple disks or annular grooves and similar work in isometric deawings are a few outof many instances where temptets of this kind can be used. H S.

Work oilstones and resor hones can be lapped straight with emery and water on a flat from plate

Get Rid of Your "Spare!"

That unsightly, turoustreas over the audienses in as unnecessary the den Here's he way . who had not be but by he is work brooking exercises. The work brooking the Corporal "boly will



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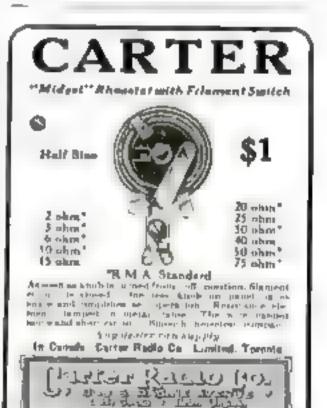
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"Cave-In"

Continued from page 113

compader, crushed beyond recognition, All through that night, and the next day the first efforts of those above to penetrate downward through the slaft seemed all but hopeless. Death lurked at every step, for now and again a lossened boulder feli and roared it to the inky blackness. The lowest depth to which the reseners count penetrate was the second level about 200 feet. Between them and the imprisoned men there removed nearly 600 feet of debris. They knew they crist sink a new shaft rebuilding the shattered walls a font at a time, from the And so, while some of the rescriers dug into the debris, others were busy rebund ug the cribbing with plants, posts and steel guilers.

These were the 'front line" men. Supporting them from the rear was a force of negrand materials concentrated at the top of the shaft. Here were stacked great pies of himber and steel for the sugarles. Here crews of t moermen cut lurge muse timbers to the proper size and shape. Other crews of welders burned steel guidees to size and bored bott holes he which the girden could be fitted in grace heli-w

NOW and again there energed daring leroes who, in the desperation of struggle, gam and their lives in attempts to expure the busck base. Alfred Makiwas one. Thereig the first hours of rescue he racked being enished to death by boulders in a vain effort to charb apward from the bottom of the shaft. On the second day, he was lowered from the top, But his powerful light could not pierce the gloom of the shym below,

Another miner, John Matala, made the attempt. Three minutes after his return to the surface, a cave-in dropped tuns of earth into the shalt where he had been

The second point of attack-that of drilling a narrow communication hole 4.2 feet deep straight nownward from the second level-offered little more bupe of immediate success. Three precious turn presed before the ded ing could be started for it was precisary first to dig a basiel twenty seven bet apward from the second level to enable experts to install a dimmond del-

The ned, consisted of a short piece of pupe in one end of which were set five distrouds, as in a dismond ring. The drill was screwed into a sarger length of pipe and revolved by compressed air B trig through the earth at the rate of amount torce feet an hour of had gone down about a quarter of the distance toward the goal at the time of the rescue

THE third onslaught, directed diaglevel of the neighboring Aurora shaft. seemed to offer the best hope of success. Here a rescue crew of sexteen men, working a four your shafts, toded consciously with there drills to open a narrow way into the dirigeon above. When the reserve came they had gone more than bulway They had dug 280 feet, with mount 200 feet still to go

All this time. (Cantinued on page 130)

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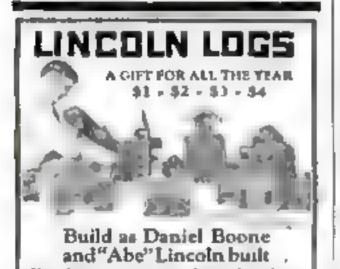
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"Cave-In"

(Continued from page 120)

near the bottom of the wrecked "G slaft Hawes, Olson and Erickson were prining their faith on the pian of boring and chamberg upward. In the beginning, Hawes had suggested this plan, after he had studied a climit of the l'abst mine.

"It could be done tothers had agreed, but you'd still be a thousand feet below them they re on the eighted level."

The fallen rock isn't pucked tight in the shaft. Haves had replied. I if a hole tag enough for me to crawl through to a level where the shaft is open, and I/II find a way to climb up through the shaft from level to level."

THAT was on Saturday Frickson took charge of driving the vertical tubisely up from the twenty fourth level It was extremely deficult. The passage was made about three feet in chameter. Only one man could work in it at a tanc. and he was compelled constantly to brace. the shaft as he progressed, to prevent a cave-in. At intervals, as they bored from level to level, the resences tapped the mann shaft to learn whether or not they had passed beyond the obstruction. At the twenty-first level it was stall blocked, but beyond the twentieth it was

It was then that Hawes made good hupromise to "find a way to chiab up through the shaft," and was finally rewarried by gresping the log hand of Tom-Frewarths and receiving the joyous greeting of his men.

During the days of imprisonment, Trewartha had proved that he too, was a safety expert, trained in the science of rescue. After the cave-in he had led hor men to the task of bracing the entrance to the eighth level with steel mils and tunbers, to guard against further caveias. Then, gathering his men about him. be laid plans for escape. Its this time the three "road monkeys stranded in the threeath and engateenth levels had c index up the shaft ladders to join the of hers.

ODDLY enough Towardua's schemes of escape coincided almost exactly with the expedients devised by the rescuers, and he and his mer attempted every one of them. First volunteers tried climbing down the shaft then up. There was no way out. Then they tried to beeak through to the abandoned "C shaft Final v they attempted to dig a tunnel through to the Aurora mine, little dream nig that rescuers were degring toward them from the other end

hor the final act in the rescue, everything had been prepared by experts hours in advance—food, hot drinks, warm blankets, doctors, nurses. At the bottom of 'H' shaft elevators were waiting to enery the men to the surface. And above, on a siding close to the pathead, stood one of I note Sum a name rescue cars with complete first and equipment. It had been rashed to the seeme from a lown in

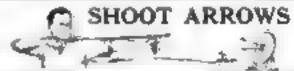
So, by the methods of science, the lives of forty-three mmers were nuraculously saved.

Ship Model Plans



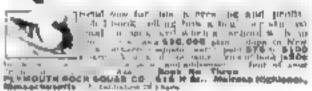
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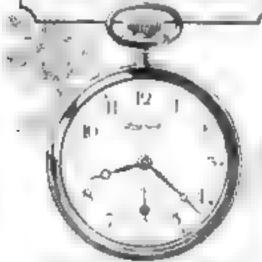
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Advice for Popular Science readers regarding safe and profitable investments. See page 4.

Your Feet and Shoes

unitaried from page 26.

have a short Achdes tendon, so that for her, the proper shoe had a heel of more than medium height. In her case the low beel merely made additional trouble

Style and the construction needed to remedy unusual foot conditions cannot always be combined. And when confronted with a choice between painful feet and a specially made corrective shoe, most women prefer the pain.

One day the wife of a department store manager entered the salesroom of a corrective shoe company. Her feet had been giving her extreme pain. She had come, under protest, only on the orders of a foot specialist. She was twenty-eight years old, modishly dressed, and more than ordinarily attractive. The shore manufacturers gave particular affection to her needs. She was on the verge of serious foot trouble. They selected for her a firm rather round-loed shoe that looked ake the ordinary well made walking shoe in all respects except one-it had an unusually long, low heel. It was that unusual heel that aroused the lady's most atremutes objections. She litted into tears and refused to wear it

BUT three days later she was backmanager was a little set around the jaw His wafe put on the shoet. She islantted they made her feet feel better. She wore them out of the store. And the end of the story? For several months the lady wore those detestable shoes. Her feet got better. As soon as the pain was gone she threw the shoes away—and went back to wearing regularly the styles that had made the trouble in the first place.

Though an arch support gives relief it does not in itself effect a cure. In the military service, arch supports are not permitted. The cure for fallen arches is to band up again the strength and elasticity. of the unseles in the sole of the foot

After about three months of wearing proper shoes, foot experts tell me, feet should be re-fitted. This is because the muscles get a chance to develop after being given plenty of room. The second fitting will usually last undefinitely Permanent improvement comes slowly The wearing out of at least one pair of properly fitted shoes ordinarily has to

NEXT in importance to wearing the right shoes is proper walking. Don t toe out! Toe straight ahead, or even (if you have fallen arches) slightly in. Avoid undue strust or long walks on bard pavements. One physician suggests that people unable to get away from city pavements by walking frequently along the cracks in the sidewark putting one foot directly in front of the other. This necessitates a certain amount of balancing that tends to strengthen the muscles in the foot, and, m addition, throws the weight to the outer edge of the foot.

Next, almost as important as proper walking, comes proper resting.

A good rest is the first step in starting remedial treatment; this so arch support may give. Weak (Continued on page 1.



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Mad Bury

Nonh Beery, the awashbuck og Sergeant in humous Players' Bleau Geste," and other feature a me, known from personal experience that the fellow who gets ahead is the one who can do things. That's why he is giving his own sen (pictured here with Wally Reid & boy) a saxophone for Christmas - a arring had a gat on the road to pleasure and popular its

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Your Feet and Shoes

(Continued from page 131)

feet can be helped by being given every available opportunity for reasation. good position is to sit with the feet crossed, resting on the outer edges of the shoes. This allows free circulation, full relaxation, and a complete change from the walking position. It's not particularly elegant, but it's comfortable and leadthy. And at least it means you look at ease, like a camp stool.

Finally, proper exercises and care of the feet are necessary. Two or three minutes a day devoted to foot exercises just before going to bed will anially accomplish wonders. Move the feet about in every direction, wiggle the toes. Lry to pick up marbles with your feet Walk along a line in the carpet, throwing the weight on the outer edges of the bare

Nails abould be cut straight across instead of round, as finger nails are.

WOLD water tones up weak feet. One Countries that many people make is to put acling feet as bot water. That tends to weaken the muscles and bigaments, though a may give temporary relief from pass. The proper treatment is the exact opposite. Just before going to bed put the feet, for a few moments, in cold water That hightens them up, steengthens and revitalizes them. A brisk rub will quickly bring them back to warmth. Alternating but and cost water, changing quick v from one to the other without giving the feet a chance to soak, also frequently gaves good results.

Massage helps weak feet by stimulating the blood circulation that builds up the aniscles. Such feet should be knewled and rabbed with the hands right and georning.

"It's Brains Against Brains —Fighting Gorillas!"

(Continued from page

a booming, echonig none like a big drung "The cracking of the underlansh told me that the whole band was after us Hearing them, the young gordlas we had caught began to squeal, just as I was assembling my me toor protuce carners in the large of getting a sensational strip of We were in the clearing, and I tolast expect the gordlas to come out from the cover of the trees, but hoped they would come near enough to the edge of the woods to enable the camera to ps ture them.

tordlas think much like humans. they weigh their chances and do not plunge headlong into danger, as do the elephant, lion, those and buffalo Against a showing of superior force they usualty take it out in coarnig, incless enraged to the point of incontroned fence ty when their young or family is theratened. And, I suppose, they give billians credit for being as strong as they are, the two races, man and gordla. resembling each other in so many other ways. Otherwise they would never hestate to attack man. I am sure.

"I had three (Contravel on page 131)

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SEND NO MONEY Genuine Full Cut Dramonde

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Gold Men a Initial or Egiblem Ring. Dani ndi \$25 4 itte White Gold Fop Ooki Embiris inny Leidee) or any initial (. Id Employ) Gold, inlaid in Gen-HOPE RUNY

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(\$ This real on a radio, tool, or all burner advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

"It's Brains Against Brains -Fighting Gorillas!"

(Continued from page 182)

natives with me this time. To one, the gun bearer, I turned over the crank of the camera with instructions to keep turning until I told him to stop. Flanked by the other two, each carrying a squirming gorilla infant, I advanced toward the place where the shaking of the shrubbery and the maning of the beasts told me the band was assembled.

"They kept up a continuous thunder of drumbeats as we approached, but I couldn't see a single gordla through the dense underbrush. The racket finally became so threatening that my two natives holted with the captives. And that, it seemed, was what the 'old man' gor lin had been waiting for. I was alone.

"HE CRASHED toward me through the underbrush, a huge hairs towering bidk, walking erect, almost like a mad, with his great arms hanging to his knees. No wander the unarmed natives fear the gorille. But that was an afterthought

"I fired once. He was so close that I could not miss. He fell dead, almost at my feet, and the rest of his family fied

auto the forest.

As no lay there, in the center of the ancient volcano of Mokeno I measured him. Sax feet tall he had stood in life. His foot was twelve mehea long; his fish when closed would have fided a galion measure. I estimated his weight at 4a0 pounds, and do not think that is exaggerated. His moseles stood out in great knots, indicating his tremendous strength

"He seemed so human, like some prehistoric ancestor of our own race, that if I had gone into the gorilla country for the sport of killing them I believe I would have abundoned my expedition then and there. But I was on a scientific mission this time, and the skin and skull of that monster are now being mounted in the National Misseom at Washington, the only specimen of the full grown Livia gorilla postessed by any m iscom.

While he was talking I had noticed that Mr. Burbridge rubbed his left hand frequently. Now he caught my glance and held his haird toward me, so that I could

see the senze upon it

"FIROSE are mementoes of one of the most exciting experiences I ever had with a gordin,' he explained. "I determ-ned to try to get at least one live gordla larger than the babies which had preyously been the ordy ones captured. The one I picked was a male, perhaps seven or eight years old and weighing one hundred

and twenty-six pounds. "I got hum, the largest gorilla ever taken alive. But after the battle a survey of the field showed two fingers broken on my left hand, the left thumb mangled, both hands becerated where he bud used his teeth, and half a dozen of my natives lying around, mauled and The underbrush had been bitten. trainpled flat in the struggle. A bloody trail led off into the forest, left by another gorilla who had tried to interfere but had been shot by my (Continued on page 143)



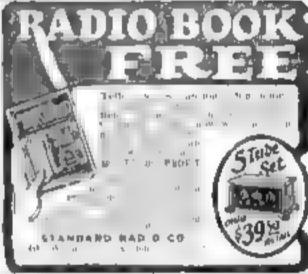


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This Full-Floating Rotor Shaft

Adapts the New Hammarlund

To Any Condenser Arrangement

It may be adjusted without enting, to accommodate various types of dists or replaced by a larger shall for gamp-operation distrator accordance with the prime of two or more condensers, be for mounting a variable prime out. Genra care or pulleys for any desired method of single control multiple condenser operation can easily be attached.





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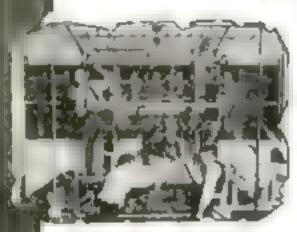
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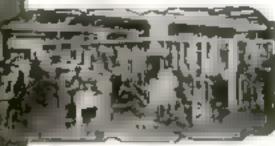
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Mame ... management ... Address,

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For the best letter of 170 words or less answering the question—

"What advertisement in the 'Money-Making Opportunities' Section interests you most-and why?"

we will pay on January 10th the following-

CASH PRIZES

\$10 00 First Prize Second Prize 5 00 Third Prize 3.00 Seven Prizes of \$1.00 Lach 7.00

First read every advertisement in the Money-Making Opportunities Section on pages 134 to 165. Pick out the one that interests you most and then write a letter—not exceeding 170 words - reiting us why you find the advertisement you have selected the most interesting.

Entries for the contest will close on December 1st. The prize winners and their letters will be published in the Pebruary (1411) of PUPULAR SCIENCE MONTHLY.

> Address your letter to Contest Editor

MONEY-MAKING OPPORTUNITIES POPULAR SCIENCE MONTHLY 250 Fourth Ave., New York

PRIZE WINNERS

In the October Contest

PIRST PRIZE \$10.00 Alfred A ter Brons N Y (American Sch. of Asiation)

SECOND PRIZE 63.00 Ben F Sentam, Knorville, Term. Prohibe where you ber THURD PRIZE \$3.00

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Electrical Experts Needed Everywhere - Let Chief Engineer Cooke Train You Right at Home

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Why stick to your no-future \$25 to \$30 a week job when these thousands of men no smarter than you and with no previous experience are jumping ahead of you—easily earning two to four times what you earn, year in and year out?

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Chief Engineer Cooke has written a wonderful book about electricity, its opportunities for young men, and what these opportunities mean to you. It is printed in colors, has 64 pages and more than 100 pictures. It's the same book that

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"It's Brains Against Brains -Fighting Gorillas!"

(Concused from page 135),

gun boy. But in the middle of the field squatted a squirning sack containing Bula Matadi, the largest gordin ever caught, a ive and unharmed.

Bi is Matadi however, did not live to reach the coast. Five of the eight gorillas I captured on my two collecting trips died from various causes. Bula Matadi was stung to death by a troop of marching ants which visited his cage one might, as the companiest.

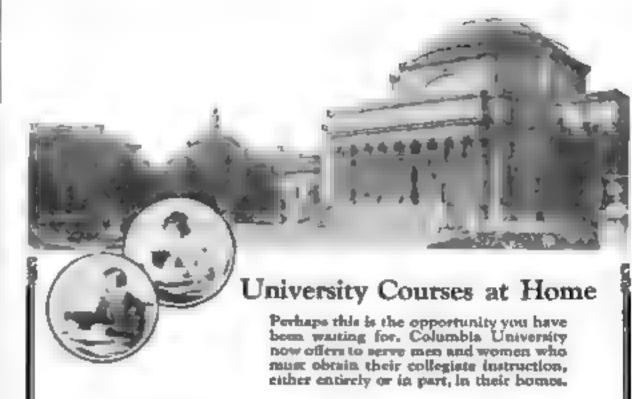
ON MY first gorilla expedition, in 1973, all but one of the captives died on the long march through British East Africa to the Indian ocean. That one I gave to the Antwerp Zoo, where it died a year later. On both trips I entered Virica at the mouth of the Congo and came out clear across the continent on the east coast. The last time I had two gurillas anve when I reached the coast, one for the Autwerp Zoo and one for myself. Again the one I left in Belgium deed, so that Most Congo is the only survivor of the eight. She is a wonderful animal, almost human. You ought to go over to my brother's country place, at So th Jacks as Re, and see her

I did. I spent half a day visiting the only hving captive gorilla in the world, and mary ching at her likeness to a human being. What struck me as most humanlike were the shape of her skull, her use of the facual insueles of expression, which are hardly developed at all in the other apea and only partly in many of the darkskinned races of man, the perfection of her cars, precisely and human cars—the gorilla is the only animal besides man which has car lobes—and the perfect homan type of her finger nails. Except for her mability to oppose her thumbs to her fingers, her hands are like those of a homan, and she uses them as deftly as many h man beings use theirs.

THERE is no doubt is my mind after watching Miss Congo's manifestations of intelligence, that she possesses a quality of intellect comparable with that of miman beings. That she can think and reason in telligently to a conclusion, instead of acting solely from matinet and emitation as in the case of every other beant, is also the verdict of Dr. Robert M. Yerkes, the distinguished psychologist and editor of the Journal of Comparative Psychology, who had just completed a six weeks test of the young gurdla's mental powers when I visited her

One of Dr. Yerkes' tests was particularly conclusive. An orange, of which the gordin is especially food, was hung at a point where, in order to reach it, she would need a stepladder or its equivalent. Three grocery boxes were scattered about the yard, within her reach as she roamed at the end of the long chain with which she is kept fastened to a huge live-oak. (Yale locks are used, meidentally, mace Moss Congo learned how to manipulate the common spaffles first used and began to roam around the banks of the St. Johns. River.)

She surveyed the (Continued on page 144).



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than a west from page 2 why

orange, quickly concluded it was beyond her reach, suratched her ear for a moment. then examined one of the bures reflec-Suddenly the idea struck her She dragged the box under the orange, climbed up on it and tried to reach the front. It was still too high. She sat a while in deep thought, then got a second box and piled it on the first. She seemed to recognize that she had found the method, for when she fulled on her second attempt to get the orange it took her but a moment to pile the third box on the other two, clamber up and seum the fruit.

NOTHER test consisted of placing an A apple inside of a length of drampipe. out of her reach, and leaving a pole lying where she could get it. After trying to reach the apple with her hand, she been only a short time for reflection before getting the pole and politing the apple out of the pape. A memory test which she successfully passed was letting her see some food of which she is fond placed in a glass jar and buried in the sand, then several days later letting her loose in the neighborhood of the cache. She remembered and quickly uncarthed the iar.

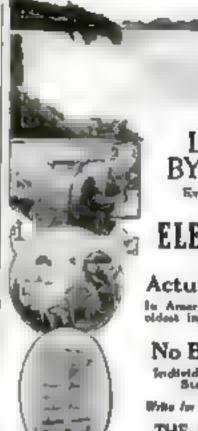
Most of the deaths of gorillas in cuptivity, Mr. Burbridge believes, have been due to too close confinement, improper feeding and the contracting of diseases, such as colds, paeumonia and tuberculoss, because of too close association with people. Miss Congo has been kept out of doors ever since she came to Amerwa and has never been ill. When also was brought to Jacksonville she weighed forty-five pounds; eight months later abo had grown to one hundred pounds, under the careful feeding of Mr. Burbridge's sister in-law, Mrs. James D. Burbridge, of whom the gorilla is especially fond.

Since the normal span of life of the gotiles is believed to be about the same as that of man. Miss Congues and expected to reach maintify for another eight or ten years, and her captor and foster mother hope that she may furnish a fruitful field for another fifty years and more for the study of her mysterious race and the relationship between man and the beasts.

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New Crime Remedies

Continued from page to

the records of Dr. Wechsler's emotion detector, the truth serum results form a part of the evidence which a psychological detective can accumulate and which he must take into account in formand his remelasions.

\ case of Dr. House's illustrates this. A boy was accused of baving been one of two men involved in a holdup. The other man was shot dead and the boy was arrested on the spot, the two victims who had been attacked having been polyemen to disguse. The case was apparently a clear one. Dr. House tried his serum on the boy, with the latter's совменЬ

NDER the drug there came out an almost unbelievable story of how the lad had been induced to join the excursion, without knowing da purpose by the man who had been shot dead. The boy was truthful. Facts already in possession of the police fitted into the tale. They explanted the story, the story explanted them. The lad was freed, thus saving an amovent person from virtually certain conviction.

Another famous murder case which has rest an enormous sum and is still not settled to universal satisfaction is the Massachusetta case of Sacco and Vanzeth. On April 18, 1920, a paymaster was held up and killed. Sacco and Vanzetti, who are anarchists, were arrested, tried and convicted. Alibit presented for them were rejected, although on the face of the recorn they seem strong. The case has been re-opened recently for a new trial

Here we have a case in which the paychological enumeration of the accused men wound undoubtedly be useful. It is almost untlunkable that these two men, neither of them experienced in decest. count go through a careful examination by a skilled psychologost without d school ing facts which would help vitally to determine their guilt or innocence. If these men are innocent, an examination of the kind might onve them from terrible injustice. In fact, more than one instance of noncarriage of justice in the past could int have happened bark psychological exammation of prisoners been in vogue

N NOVEMBER 1917 Mrs. Annetta Morella killed herself in her coom in Newark New Jersey because her husband had been drafted and was going to war-Her husband was in the room at the time. He was arrested and examined in Italian, through interperters who were not sufficiently familiar with the dialect which he spake. He was convicted, the interpreter having reported that he confessed. whereas he had really tried to say that his wife had committed suicide. Not until 1920 was the mustake discovered and Morello freed, after eight years of jail

In at least some of these cases devices like Dr. Wechsler's would have helped to extract the real truth from the witnesses. In others, the second kind of psychological investigation could have been employed. the kind which being us to decade whether the crime and the suspected criminal are psychological mates. (Continued on page 148)



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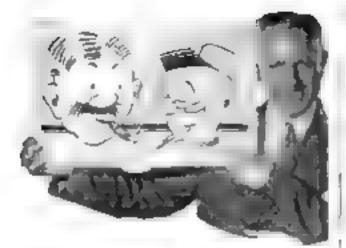
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New Crime Remedies

(Continued from page 145)

In a famous British case of eighteen vears ago, the case of the murder of Marion Gilchrist, tests of this kind would probably have saved an innocent man from prison or hanged him if he was

Marion Gilclimst was no elderly spinster. who fived alone in a small apartment in the city of Glasgow, Scotland. On Derember 21, 1008, she was brutally murdeted in her home. A man was seen runming away but was not captured. Four months later a man named Oscar Slater. was arrested, convicted and sentenced to be hanged. There were grave doubts of ! his guilt, which was indicated almost entizely by curronistantial evidence in which it is quite possible, even at this late day, to pack serious flaws. Influenced by this fact, the Home Secretary, who is the pardowing authority in the British Istes. commuted Slater's sentence to life impresonment. So far as I know he is in prison yet.

IF SLATER was moocent a fearful mus-carrage of justice has occurred. If he was guilty, there was still a intscarrage. for in this case the Scottish law required that he he hanged.

In experienced detective or eriminal pulge acquees, of course, instructive power of judging this ability or mability of a certain suspect to commit a given crime. "That's not his hond of a job, " they say I soully they are right. It is merely long experience and acute observation of character. What a series of paychological tests can do is to supplement this to do it better and more certainty.

The tests used for this jumpuse areains lar to those now need by many businesses in selecting employees. They determine the habitual quickness of movement and of reaction to stimuli, like nonex or touches. They test general intelligence. also, and mental stability of the witness or his tendency to get excited in an entergency. Still others test his muscle control-a matter of importance, for example, in deciding whether he could fire a revolver accurately during a moment ! of excitement.

BEGINNINGS in these psychological methods of ertifinal examination have been made in several cities, initably in Berkeley, Cabfornia where Police Chief August Vollmer is well-known for his close contact with the scientific departments of the University of Cabfornia and for lossise of screams of all kinds in the city police work. In some of the larger cities, notably in Los Angeles, Calif., and in New York City some tests have been made with such methods.

Every court or police station having to do with many eviminal cases should possess its psychological laboratory, equipped. with apparatus for the general testing of character and in charge of a competent and experienced psychologist. In cases like the Hall Mills case or the Sacco-I amzetti case the savings to the state would be thousands of dollars, now spent in the examination of witnesses who disclose nothing important

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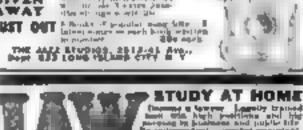
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A Camera Hunter Tells His Secrets

Continued them and

rest. The canters, adjusted for sharp focus at thirty feet, is supported from a mound across the bow and the flash lamps are about thirty laches above. Another camera may be focused at twenty feet.

Noiselessty, the boat pushes off into the darkness. The photographer kneels in the how just belood the camera, ready to push the button that sets off the flash pawder. The powerful twin flash lamp, only two feet above his head, is loaded with two tremendous charges of highspeed pawder which, when they explode, one he leaved two or three miles and seen in the sky ten or fifteen

HETTERNS the jack from side to side, lighting up the wooded shore. Suddenly two bright balls of fire appear A gray form becomes visible and at last the wat hers see the graceful mage of the deer. The jack blants ham and he cannot see the boat beaut. As the light drifts may a smeatly nearer the deer becomes nervous, more nervous. And at there feet, the photographer presses the button. With a roar and a blanhog light, in a 200th part of a second the picture has been taken. As the echoes de, the smort of the fleeing deer is heard.

At the other et. of the scale is the photograp is of insects on while field, for there are 250,000 known species of them. Insects are usuals photographed by being put in a glass-sided enge and given an Lour to quiet down. But very active specimens have to be chloroformed for a few seconds and photographed before they "come out". A most interesting series of puttires can be taken through the night, by flashinght, of a spider spiriting its web.

Remarkable class-up photographs of monstrous insects now are being made by a new decise a camera fifty feet long. This is constructed by mounting an extrating focus lens on a long light-tight wooden trough, parated black inside to prevent reflections. The insect is placed in a block, which is moved before the camera until sharp focus is obtained, and the lens stipped down to increase the

depth of sharp-focus field without pro-

surging the exposure too much.

THERE are all kinds of roses to outwit the birds you want to photograph, says Mr Neshit. One is to put a feeding station on your wantow sill and take the picture from maste. To eatch a woodpecker, put met in the crevices of the bark of a tree, but if you want to get his head while he is pecking you need a souther speed of 1 300th of a second.

One of the best known wild life purtures in that of a fish hawk in the act of striking the water after a fish. The photographer anchored a wooden goldfish six inches below the surface, with a thread reaching to the shore. He himself hid behind a blind on the shore, his camera ready and focused. When the mark have in sight, he jerked the thread moving the fish to attract the hawk's eye. Then came the swoop.



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They Can Fly with Their **Eyes Shut**

(Contraced from page 21)

was absolutely as well as hopelessly lost, a 'I dropped a flore, and m landing bit a tree. I was in Bloomsburg.

Unjest exactly one year later the night of the Dearpsey Timney fight after flying blind for nearly two hours in the fog I came out of it again I was over Bloomshorg, But this time I knew exactly where I was.

What Captain Chaudler considers his narrowest escape also occurred near Bloomsburg. Having passed over the raty, he lost his desection in the for. He turned and again flew over the city II on he deopped a flare. The magnesoum light disclosed an oat field opposite Rupert in which be made a perfect banding. Cetting lus bearings quies s, he prepared to takesoff. By this time is crowd had gathered and stood watering annu-

MIANDLER shoulded a warning and C started off The pane bestored more enter over the out field, and becaut to rose. Loo late. Chandler realized that the out stalks had become entangled or his tanding wheels and were duminishing his spend as he mee

Looming up ahead, too close to avoid and too high to rear with his retarded panc, was a lorge tree. Beyond was the

Seisoportoniana river-

A ery of dismay from the speciators a trash of reading tiltaer, and the great plane had rished headlong into the top of the tree. Corrying top and limbs with it, the slop plunged toward the river-It staggered, they lareted on the sate, Iwenty feet away, in four feet of water

Compercenshed to the rescue. They found Unauther and a heap of branches and wreckage. The right wing of the pane lad bent over possing has beath Fortunately bus load was out of water hat he was bleeding profusely. Portions of the enclint had to be chopped away. before he could be released and carried to a hospital. There it was found be had suffered a fractured skull a broken nose. and lacerations of the head and face, yet over the protests of the doctors he directed from his bed the disposal of lasentire cargo until it was in the hands of the postal authorities.

EAN SMITH can boost of being the only air mail pilot who ever ran down

While flying the mail route from Chicago to Omaha, he strapped his gears and was forced to attempt a canding in an open field. It was a row pasture

The wheels had harely touched the ground when the cow stopped directly in the path of the plane. Plunging ahead at eighty nules, the bose of the machine eaught her squarely. In a shower of blood, the plane did a cartwheel, twisted out of shape, and landed on its back.

In flying the Cheyenne westward route, Captain Chandler's nerve and resourcefalsess saved him from what might have been a fatal accident.

As he ruse from the field at Cheyenne one day, the left wheel on the ship's landing year flew (Continued on page 149)



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-will start you on the road to success. See Money Making Opportunities on pages 134 to 165.

They Can Fly with Their Eyes Shut

Continued from page 130.

off, Unaware of the loss, he continued on his flight in ignorance of the danger which awasted his descent.

OBSERVERS on the field at Chevenne saw the wheel as it fell, but they were powerless; for the plane was already passing out of sight. Knowing the risk that Chandler would take in landing with one wheel missing, they quickly communicated with the field at Rawlins, Wyo., over which the plut would pass.

It was fortunate for Chandler that he was not forced down before he reached Rawhus. Luck was with him. While passing over the field at Rawhus, the captain saw that he was being signalled to stop, "That's peculiar," he thought, as he circled around. Next he saw that the men on the field were holding something up to him. Builing lower, he recognized it as a wheel. He immediately inspected his ship and discovered the damage. The ingenious method he employed to meet this situation has since been generally adopted.

THE possibility of such an emergency had often occurred to me and I had worked out a pinn whereby I round land in safety ' he said, describing how he did it. "I brought the ship down in such a manner as to et the wind strike it from the seft - the side of the lost wheel At the same time, just as I touched the ground, I dropped the right wing slightly, keeping the tail high

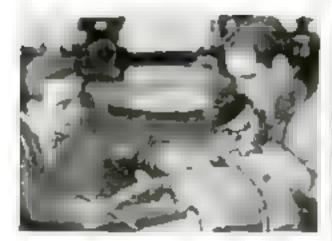
"In this manner I rolled about lifty feet on one wheel and greatly decreased my speed to the left side began to settle. I turned at first slowly, then sharply to the right. This produced the same result as closs the net of turning an auto auddenly; it tended to upset the plane to the right and put all the weight on one wheel

"By this time so much speed had been lost that I was unable to keep the butt of the wheelless axle out of the ground anvionger. I came to a full stop without damage to the ship or myself

WHILE the air minl pilots already have taken aviation out of the bit or miss class, they foresee still greater strides in the near future. They predict a fame perhaps within a year- when they will be able to fly regardless of weather keeping accurately to any course. That will be possible through the use of the radio compass, constant weather reports, and multiple motored ships. A place with multiple motors will have little to fear from engine trouble, and forced landings from that source will be all but elimmated. The cadio compass will tell them, by a system of signals, whenever they are about to stray from the route

But whatever the perfection of the instruments, the success of the air mail will always depend on the courage and deternination of the pilots. They will always go forth to do battle with the fog, the wind, the rain, and the ice. The instruments can tell the aviator what to do, but it will always be up to him to do it.





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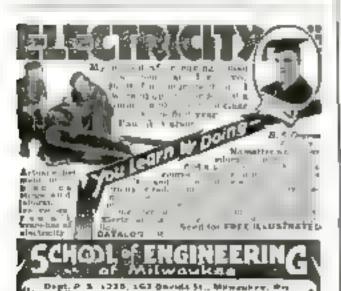
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Harnessing Thirty Million Horses

(Continued from page ...)

And the land could be tilled on a large scale with immense machines run by power now undreamed of even on our most modern farms.

RAZING land would then be plenti-I ful and feed for cattle cheap. Consequently more cattle would be raised, more leather produced, and consequently more and cheaper shoes turned out,

Follow this advent of cheap power through any industry and the result wilhe the same. Starting at the mines, iron ore could be accorped up faster and cheaper than is now the rule. Steel could be truste cheaper, and consequently tools and Every article you wear, Huz/Imery everything you call every utenal in your beasebood and everything you use in your business would be cheaper and the average man would be able to enjoy the bixuries now available only to the very rich

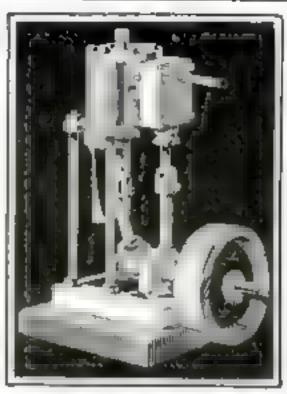
With cheap and abundant power no home, no matter how far removed from the centers of population would need to be without the conveniences of the most up to-date city apartment.

Superpower is the next step. But even superpower systems was afford only a temporary relief for our needs. In the inst quarter of a century the use of power in the Linted States has doubled on the average, every none years. Herbert Hoover estumates that we will need 30,000,000 more electrical horse-nower in the next twenty years. He believes we can produce that much at the cost of from thirty to forty bidlings of dollars for new plants and equipment. But after that what? Where will the next several bundred milhous of horsepower come from a

That is the problem now facing science. And that a why strence seeks to unlock the tremendous power in the atom.

AT THE same time inventors and engi-neers are busy, for before a new power can be applied to industry it will be necessary to find an economical and safe method of destribiting and storing it. It may be that when the new power arrives our present day storage battery will have been replaced by a new storage device built on an altogether different principle. It may be that transmission is res will be discarded. Viready experiments have shown that power can be transmitted by radio of a limited way. This method will sirely be improved on. And when we learn to direct power to any point of the company and to any distance, surely a new mechanreal age will be upon us. Sensitive devices will be invented to catch and use this power. This already has been done with certain radio devices. Slips, airplanes and trains have been directed by radio.

Professor Norris is only one of many emment scientists who are hopeful we will get at the tremendous power of the atom moner or later. When we do find it and the means of harnessing and distributing it, we may look for an era of wonders that will make our present mechanical age appear primitive.



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The profit by R. F. Anter described the most is a of market guess given atom or oppose second a loope to be the control of the second as loope to be the control of the second of the control of the cont

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The New Wonders of the Sea

(Continued from page 46

ment through the blood of the female They lose their teeth and luminescence and become almost blind

Deep-sea fishes have the most freakish forms. Part of the skeleton of the Sternoptyz, for instance, it visible outside of his hody. He is bent downward, his tail far higher than his head. Thus is supposedly an adaptation to deep water pressure, as is the buot-shaped jellyfish that lives S.OHI feet down. The Arguropelecus is entarely luminescent. Its eyes, which are enormous and are on the top of its head. are turned upward. Did you ever bear of a butterflying fish? No, it isn't a joke from Alice in Wonderland. It exists, and has wings beautifully colored, like those of a butterfly in deep blue and vertation and yellow. You wouldn't think paper would last long in the ocean, but the paper must that is a little octopus, and he lives in a de trate tissue paper shell in which he can float about on the surface

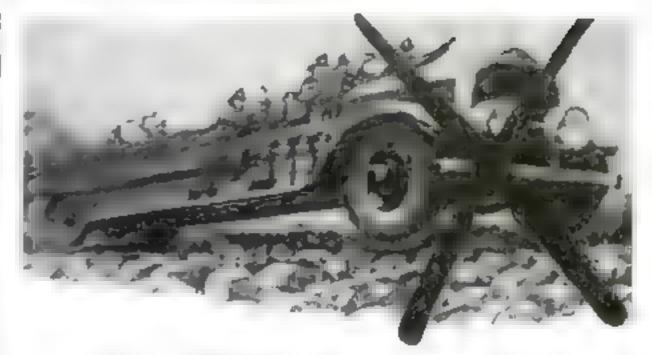
THEN there are fishes with "panes of gloon" in these atomicelus, tempoparent a conbrance through which the internal organs can be seen. There is the Union Jack fish caught recently in South African waters, during the discussion whether the I mad of South Africa should continue to use the British emblem and which got its name from the fact that the markings on the fish's aide resembled closely the

Union Jack.

All fishes are not as cold as they look. and they do make love. Professor Julian Huxley has been pecking, and has seen them Crabs aren't really crabbed, he saya, for he has seen the male ficklier crab courting. When the lady erab comes along, the gentleman atands on tiptoe and nolds aloft a highly colored claw. If she passes him by the first tune, he tries auother attitude. Male spiders carry flies. wrapped up, to their lady loves: but the later sometimes cat their husbands on the housymoon. The marine brutle worm is ured from its home by the moon, and seeks the lemale, to sport in dances by moonlight. Imponderable are the ways of

ONE of the greatest wonders of the sea is plankton, the teeming life best known as causing oceanic phosphoroscence. Those waves that seem just water, whether blue, or green or gray, are often full of minute living things, each with tta own individuality, each living out its little life.

Plankton is the star dust of the sea. floating life that drifts with winds and currents, and at night glows and glimmers as the ship ploughs its way along. It is twenty-five times as efficient a light producer as an electric hulb. It makes the sea an opaque, exidized liquid as different from water as tar is from glass. It resemliles in appearance a rich pink jelly. Its numbers are as the sands, uncountable. A gouze net with an opening a yard wide, vielded to Beebe on the Archieus a baul, one 150th of which he estimated to number (Confinued on page 152) 271 080.



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The New Wonders of the Sea

{Continued from page \$-1}

Multiply that by 150 and you get 40.662,000, which was the total haul in that one small net. Plankton is commonly called "whale food" and many fishes eat it. Human beings could live on it if they had to. It is rich in nourishment. The whole human race may some day have to depend upon it, for the fish supply is decreasing, the price is going up, and the lack may have to be filled from the untapped larder of the seu.

When we say "sen food" we think of fish and lobsters, by sters and crabs. The prices of these are going up, but there is an endless supply of other sen food. French accentists have investigated and say that all races can eat senweed with profit, as Chinese and Japanese do already. It is as nourishing as carrots, beets, turnips and paranips.

All clams, cockles, scallops and even barnacles are edible. A guant barnacle, balance remanni, that abounds on our Pacific coast, has a deletious flavor and the same food value as lobsters, prawns and crabs. Even the dread ortopus can be, and is, eaten in Eastern Asia. The sea cucumbers—they are annuals—which we do not eat, sell in Hongkong at \$700 a ton.

WHEN McGuity got to the bottom of the sea, he found imagnificent secuery unparallesed on lamit. In the tropics, with coral sponge and colored shells and plants, the vista is britished colored and of luxurious mist fantastic outlines. The sea floor is of rock covered with resliment from rivers. Then comes matter derived from fragments of marion plants and animals, shells, skeletoos, bones and coral fragments. Sometimes there are meadows filled with sponges and sea plants.

Many so-called marine "plants" are animals, and unister animals, too. The sea ancimies, roses and pinks are, in fact, pirates lying in wait for victims to devour and sate appetites that, like those of most sea animals, are voracious. Anemores are really highly colored animals with truy myrind tentacles and warts that look like flowers but are far from it.

How deep is the sea? There are fifty depressions or "deeps" known to science, varying from 3,000 to 3,000 fathoms. The greatest is forty index cast of borthern Mindanao, in the Philippines, and its depth is 5,348 fathoms, or 406 feet more than six miles. This depth exceeds by 3,000 feet the height of the loftiest mountain peak. The average depth of the ocean is probably not less than 2200 fathoms, about two miles.

THOSE are only some of the wonders of the sea. Many more are unknown as yet for occasiography is practically a new science that has developed mostly in the past thirty years. There are many important problems still awaring solution.

"Yes, there are more wonders," Dr Townsend will tell you with a twinkle in his eye. "There is the planked shad, for instance, and the planked whitefish. Did you ever see one walk the plank?

"What did you ask? Sea serpents? Tell it to the Marines!"

"Genius itself must learnthemochinery of expression."



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See New Financial Department on Page 4 - Front Section.

Ways We Use Waste

(Continued from page 8")

is harned are recovered for use. Fully as astonoshing are the new facis olstained from things which once were considered to have no practical value. In Il mois, for instance, engineers recently proposed a plan to salvage the gas now wasted in the treatment of city sewage, ; and to employ it for household hearing purposes. This gas, they my is ononeas when hurned, and has high heating value. In a city of 50,000 persons, they estimate fully 90,000 cuber feet of gas can be obtained in the way

ANOTHER surprising development is a newly discovered method of obtaining high grade fuel, resembling fuel oil, from low-grade "backstrap" mousses, which risti, buty has been consulered a waste produce of sogar remerces. This strange sweet first does nouble nuty, for the rest die, after bereitig, ean beconvertes intogotash and used for fertilizer. The procesa is the a vention of Dr. Paul G. Hittecramit el engras and meshas scal engineer. of Swartl more College, Pa. In the laboratery be has demonstrated that the fuel obtained from each ton of low graze molasses has a heating value equal to a ton of coal, and produces 130 pounds of commercial potash besides. He estimates that the salvaging of waste molasses in some 5,000 raw sugar factories in the world will represent a yearly saving of Mary MOOLOHO.

The rapid depleting of our forests lux called the attention of scientists to Die extravagant waste that goes on in the umber and istry. At least seventy five percent of every shandary tree is wasted. on the average, when it is evalverted into wither. This loss is represented in the reals, stemps, knots and tops of trees, as well as in sow built and nob shavings.

Mr weeks ago Jacque C. Morrell of Riverside, Hi., and Dr. Gustav Egloff of Creeago, told the American Chemica. Somety that they had more edd in reduring the wastes from Douglas fir into tar. By the chemical process of "crackng," such as is used in making gasoline from crade oil, they split the wood tar up into light volution silve sintable for motor biess, sosvents, and paint themers

ALMOST at the same time a bulleting test is by the New York State College. of Forestry, Symense I a versity, angounces, experiments showing that wasteproducts of the forest offer a great source. of human food. Annuals thrave on the leaves, branches, tender twigs, and sometimes the bark of trees; why not men' The Rocky Mountain yellow pine, when examined recently, was found to contain 8 19 percent protein, the food property so important to man. This is nearly as much as the protein content of wheat, which is 18.4 percent, and of field corn, which is 10.1 percent. Before we realize it, choice dishes from twigs and leaves may be a regular part of our bill of fare.

Sucha possibility, however, is no stranger than are some of the articles of food, medicines and drugs now produced from things considered worthless. The blood of animals in the (Castinued on page 165



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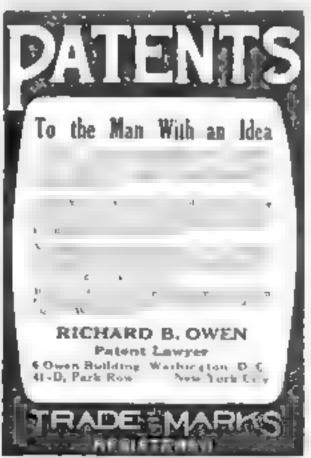
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STREET STATE

Ways We Use Waste

(Continued from page 163)

bus been thrown away. Now chemists have found a way of removing the bemoglobin, which gives the blood its red color, and using the residue to make meringues in place of whites of eggs

From fish refuse, Professor Nils Hanssen, a former head of Sweden's department of agriculture, has produced a flour which he declares is an excellent food for cows and pigs. At Gothenburg, the largest fishing center of Sweden, all refuse now is saved and shipped to a factory where it is converted into the flour and sold to farmers for fattening their live stock. The screenings are used for chicken feed

EVEN old shoes have their value. At Tofia College, Medford, Mass., a young inagician of science has succeeded in converting scrap leather into valuable drugs, medicines and perfumes. From sea, west too. Dr. J. W. Turrentine of the U.S. Bureau of Soils has extracted to the which has been found effective in the treatment of simple goster.

The nation's junk piles of metal no longer are being allowed to go to rust and decay. Last year 800,000 tons of metal from the samp of factories and junk dealers were recovered and turned linek to use a saving of some \$200,000,000. Of the artion automobiles which wear out every year and are cast ande, all but a small proportion now are advaged.

Perhaps the most remarkable example of how modern industry is learning to make use of semps in found in the salvaging plant which Henry Ford has entableshed at Highland Park, near Detroit Here 800 men are employed to turn every bit of waste to some useful end whether is be a lot of rope, an old bag, or a piece of paper. When a Ford mechanic wears out a pair of rubber boots they may be turned back into rubber tres. Old leather from sleage or aprona and scraps of new leather. are turned into washers, hand pads, gaskets and leather molds used for various types of machines. Old rubber gloves are cut up for finger protectors. Rope, bags and burlap are slorended and put into cushions. Through this endless process of salvage, Ford saves something baceighteen nullion de llars a year

WHEN Thomas A Edwar was asked some time ago whether he planned to produce any new inventions to the near future he replied. No. I think it would be better for the world of it wasted awarle until it learns how to use the inventions it already has.

He meant to tell us that we are profligate of the wonderful heritage left to us by the creators and discoverers, that we can find unsuspected value in the last scrap, if we will stop a moment in our mad pace and look for it

House Fittes have decreased nonceably in number since automabiles came, says a Providence R I health official, because there are now fewer horse stables, principal breeding places of fires,

Tunney Tells How He Won the Championship

(Continued from page 49)

the fight. Fighting fire with fire, as it were," smiled Gene,

"Have you ever stumbled over anything in the dark?" he asked me suddenly. "It's about as disturbing an experience as you can have. That's because you re not ready for it, and it was by injecting that same element of mexpectedness into my first punch that I planted to heat Jack Dempsey.

"ANY old punch wouldn't do, though.
It had to be a punch that would be sure to land-and one that carried the knockout snock, Study of Jack Dempsey's tacties as he rushed from his cornermotion pictures of his fights were available, you know-soon convinced me that a straight right-hander, timed to the instant and delivered with all the beef and smrit I possessed, was the ticket, so I began practicing that punch. I practices it against puncling bags, with sparring partiers, I bombarded the empty air with it in shadow boxing. I even let it loose at old moments as when I was wait ng for my turn to tee up. a golf ball. I went through the motions of delivering it on moving picture sets. Months ago I had it worked out to the ulmost perfection of tuning and areamey And that punch," said Gene I macy mapresarvely, "won the figat for

"It wasn't delivered exactly as I had planted I constit't said it to Dempsey's first ruon. But in an second rook, out went my right bang' -the hardest pirich I land ever delivered Jurany Bromon, my claef second, who knew all about the punch, of course, last told me before the fight, 'Land that right-hander! Break your arm, if you must, but land it? I landed it all right, half I missed. It was simed for the point of Dempsey a paw, but it struck how on Die cheekbone. It didn't knock him out but the force behald it was so great and the timing so exact that he never recovered from that blow. It stunned him physically, and surprised and disconcerted I un mentally, so that, as he himself said after the fight, he never got started.

"SUPPOSE it had not had that stun-

"I d have been in for a tough time," responsed Tunney simply "I d have taken many more terrise punches than the few Dempsey managed to land. However, I was prepared for that, too. I and made certain that I could weather a storm of heavy punches by taking plenty of them on my face and body while I was training. My spacing partners were football headquards in training. I didn't. I was training to take punishment as well as to avoid and inflict it.

"All the practicing and all the training in the world, of course, would not have assured that decisive blow if I had a that absolute confidence that I was capable of doing the job. I had to be so absolutely sure of myself. (Continued on page 1 to)

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Tunney Tells How He Won the Championship

(f extensed from page (45)

"That's all there is to the trick of becoming heavyweight champion of the world-or anything else that you might aspire to and that few without your capabilities. If you can convince your self— honestly—that you can do a thing. you can do it.

"I do believe that anyone, who, after studying his capabilities and talents, in confident that he can become a great artist, singer inventor, business leader, politician or whatnot, can achieve his mabetion how know muckly whether you re on the right road, for the fundest person in the world to deceive in yourself."

VE interviewed scores of famous Athletes on the same subject on which I talked with Gene Tunney for Port age SCIENCE MONTIDAY - themselves, and the "how of their achievements. Tunney though, is the first who has given me a satisfactory answer. He Lames box he fights, because he fights not with a body directed by native instinct and a mechaneal skill acquired by practice, but with his brains. He has been criticised for being a "made" fighter, for lacking the killer matinet." that all great performers of the ring are supposed to possess. I subscribe to both these entiresins and my but is off to him is consequence. He a not only a "made" tighter but a self-made one, and a corking good job he s done of I too! That he lacks the wolfish ferocity that emises some pugilista to glory inperindent an already braten opponent into belplesaness, in my opinion redounds to his everlasting credit for he has won the greatest prize in the gift of the ring without it

His powe, his self-control his self-confidence and his coorage are admirable

MAGINE a man who tharty are loons before the greatest crisis in list life. spends two hours in litter absorption in the task of teaching the elements of golf to a friend who didn't know a nibbek from a sand trap!

linagine a man, who follows that session on the links by going to his room. sinking his head into a book, reading for an hour or more in utter detachment from the world about him!

Imagine a man, who, keeping an engagement which means fame fortime and the achievement of his life's ambitions, makes his way to the place, over the protests of his well wishers, in an arrylane—the first time he had ever entered one!

Imagine a man who, dressed in his ring clothes and about to fight for the bear yweight championship of the world, spends the five minutes immediately preceding his entrance to the ring peacefully sleeping in his dressing room

I saw Gene Tunney do all these things. And so I do not besitate to cad lunt as I did at the beginning of this article, the most remarkable young man who ever entered the prote ring, and a young man whose influence as beavyweight champron is bound to reach far beyond the world of sport.

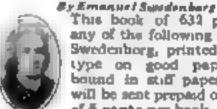
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Advice for POPULAR SCIENCE MONTHLY readers regarding safe and profitable See Page 4 investments.

Is Your House Heated Properly?

(Continued from page 4.2)

slight argument between the one-pipe circuit and the one-pipe relief layouts. intomatic air valves above the steam mains improve the system. Steam supply mains should slope away from the boiler at the rate of one meh to ten feet while the return pipes which carry water of condensation must pitch back at least at the same rate to the boder

' Pipes that mag or lack the proper uniform pitch cause those unbuly gargles and knocks that some people regard as the mevitable music of a steam plant A defective air valve at the radiator may also cause the turnult. Sometimes a correct air valve in fusied out of order Adjust it once and then leave it alone."

"COME of our friends who have hot Water systems recommend them

highly observed Lien.

Every Arab prames his own camel, according to the proverb, but in this case your friends are quite within reason. Yout the only drawback to bot water is the too skin purse of the prospective owner who can tafford long run economy Water returns heat and ermits it steams tending to keep the house temperature more uniform than do other methods. There is no noise, no valve fixing, no pressure anestron. The same water is used indebutely but for that matter a sleam honer requires or is a tribing repleashment of water during thesenson-

Do we figure hot water size the same ns stemm? asked Hob.

I se the more runs but add autty-five percent for extra radiation surface meded to compensate for the relatively low temperature of hot water, usually around 18st degrees. This is like vapor compared with steam, only more so In the example of the steam heated room we discussed, 46% ft. of radiation was responed. For hot water, adding sixty tive percent, we rame the requirement

to 70 % sq. ft.

"I'V) GET the boiler size, take the total • of room needs, add one third for juping (instead of one quarter as in steam, berause there are more pipes) and seventyfive percent for safety margin. Hot water requires double piping-you notice that a radiator has top and bottom cooper hous -also it cods for an expansion tank in the attic. An altitude gage at the boder tells whether there is enough water in the expansion talk, saving steps to the attic for inspection.

How does not water cost compare with steam?" inquired the young mail.

"Well, we have already seen that the material for the first is more than half as much again than steam of the ordinary type. Lapor for hot water installation. is estimated at two and one half to three days for man and helper per radiator. while steam ungar pipe circuit takes but one and one fourth days for man and helper per radiator. While these work estimates are given by an authority. have seen a smasl installation of steam done in half the time abowed.



The Proposition of a 1877 page 12 is a 17 or of 1971 page 12 is a 17 of 1971 page 12 is a 1971 page 12



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Benjamin Franklin, Experimenter

he says that "it was no small mortification to me that I happened to be abroad taway from home) during two of the greatest thunderstorms we had early in the spring. I had given orders to my family that, if the bells rung when I was away, they should collect some of the hightning for me in electric phials, and they did so, yet it was mostly dissipated. before any return. He was not upon the trail of aghtning

Purture this nights respected, someweat rotund citizen upon the floor of his blinery on hands and knees. Scuttered about him

paper, twine, odds and ends of old silk ! rags from Mrs. Franklin's acrep bag. His Philadelphia friends were certainly pistifiel in enising their eyebrows. knew him for an inventor, of course but ! of he was perfectly same, why should be be crawling about in his short sleeves with his mouth full of purs or tacks?

Looking back upon all this new year can get a glumpse of the vonthfulness of Franklin. Who but a boy would think of sending up a kite to snatch a secret from seaven?

KITE As always, we can find no A better words than his own, to deseribe just how he proposed to construct and equip it

"Make a small cross of two light strips of cedar, the arms so long as to reach to the corners of a large than wik hatofker. chief when extended, the the corners of the handkereloef to the extremities of the eross, so you have the body of a kite. which being properly accommodated with a tail, loop and string will rise in the air like those made of paper.

Anyone can follow him so far and doplicate his construction always remembering that salk handkerchiefs, in locday of male finery, were larger than they norally are powadays. A bluepickets. neckerchief might serve the purpose of it did not prove too heavy and Franklin takes core to explain why it should be

"This being of silk is fitter to bear the wel and wind of a thunder gust without

"To the top of the upright stick be continues. is to be fixed a very sharp prented ware, essing a foot or more above the wood. To the end of the twine next the hand is to be used a silk result and where the alk and twine join a key may be instened.

LITANDREDS of times, in school read-I I egs. histories and other books. Franklin's kite experiment has been descaled. But one point seems missing.

accurate data on weather conditions on the day of the experiment

Within very recent years kites have been flown by professional scientists just as artificial lightning of tremendous power. has been manufactured in laboratories. Results show that it is possible, with a kite flying in clear weather, to get the effects credited to Franklin. But if he and flown has kide Continued on page 1 (2)





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Advice for Popular Science readers regarding safe and profitable investments. See page 4.

Benjamin Franklin, Experimenter

Continued from page (48)

ut such weather, matching down the lightning when there was none visible in the sky, surely he had far too good a sense of the dramatic to miss giving anything southerlying the very wislest publicaty

On the other hand, suppose he had flown his kite in a real thunderstorm? A frightfully dangerous thing to do. We should then have had no Franklin to improve the Declaration of Independence; no Franklin to be a successful Minister

Early biographers and historians knew little about electricity—they could not check up the scientific side of the experiment And Frank in left behind no exact date, from which it might be possible to discover what the weather actually was on that memorable day. No one will ever know the exact conditions of the great test, but here is his description of the method and the result

"Fy III's kite is to be raised when a the rider god appears to be coming or and the person who holds the string ment stand within a door or window or under some cover, so that the silk riband may not be wet; and care must be taken that the twine does not touch the frame of the door or wandow. As soon as any of the thunderclouds come over the lute. the pointed wire will draw the electric fire from them, and the kite, with all the twine, will be electrined and the loose filements will stand out everywhere and be attracted by the approaching anger and when the rain has wet the kits and twine so that it can conduct the electric fire freely, you will find it stream out plentifully from the key on the approach of your knuckle, and with this key the phial bias be charged.

Visit from electric fire thus obtained spirits may be kindled and all other exetrue experiments performed which are passally done by the help of a rubbed glass or tube, and thereby the sameness of the electric matter with that of lightning

con plete y demonstraten.

Selecteds most suggest that the engrent was induced that is, created by influence across a space, not by actual contact. If the kite string had been wet enough to make a good conductor, bringing the current down to the key, it is hard to believe that the "mose filaments of the string would stand out everywhere 'But, exmain it as you please, the conclusion that lightning and electricity are the same thing cannot be denied. Most of us, in spite of the difficulty of understanding how he did it, leave Franklin with the eredit for Diat discovery

IGHTNING takes many forms, often a unnoticed because we are not as a rule enthusiastic about thunderstorms. Zigang flashes are not really signag at all. the flashes curve and wind, more like a river between its banks. "Sheet" or summer lightning is chiefly the effect of reflection against the clouds, so far away that we hear no thunder. The globular type is more Continued on page 160

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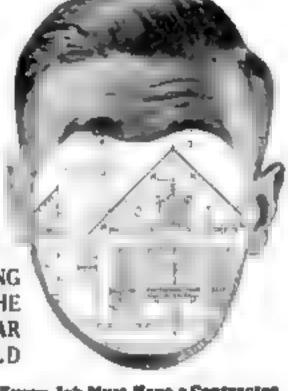
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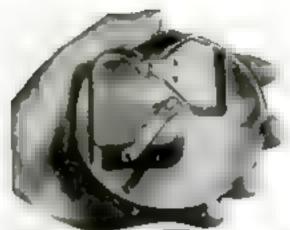


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Benjamin Franklin, Experimenter

(Employed from page 119)

rare, but the writer once watched such a ball roll down through a pine tree fifty feet away, splitting it from top to bottom almost as neatly as a golden circular saw. about the ause of the sun as it ordinarily appears to us, might have done it. And there is the recorded case of such a ball tumbling into a room, rolling across the floor and out through a crack in the wall without injuring any of the occupants,

"Rubbon" or multiple lightning, still nsore rare, is due to a number of parallel flashes, so close that they seem to make one long ribban.

DOCTOR STUBER, a contemporary of Franklin's, is said to have known him well and to have got from him the atory of the historic afternoon

His late " agvs Stuber, "was raiseda thundercloud passed over it-no aga of electricity appeared. He almost desparred of micress when middenly be observed the loose fibers of his atring to move toward an erect position. He now presented his kniickle to the key, and received a strong spark. How exquis te must his sensations have been at this moment! On this experiment depended the fate of his theory. If he micreeded, lus name would rank high among those who had improved actence; if he faded, he must inevitably be subjected to the derision of mankind, or, what was worse. their pity. Doubts and despute had begus to prevail when the fact was ascerthines im so clear a number that even the most meredulous could no longer with hold their masent,

WAS Doctor Stuber accornte in his account? It is too late, now, to find that out. But nobody can deny that it is a fusemating picture of Franklin that he gives us.

What other moment of his life could compare with that one? To stand up to a withering fire of questions by an English Parimpient was one great hour. To stand up in the American Constitutional Convention and suggest equal state votes on matters of sovereignty in other words, to save the Constitution by sowing the seed of today's Senate At A tuesus of securing really equal representation. Was another great hour

But to be left standing out of doors facing single handed the greatest force in nature and sharply outlined against the binzing crashing heavens?

Proter poblician, inventor: author diplomat, and paoneer American scientist count Franklin himself have demanded more of fame than that?

LENGTHENING the life of sponges by passing them through machines with spiked rollers so as to mercase the honeycomb, is the idea of a Turkish inventor, After the sponges are brought up by the divers and cleansed of "milk," they are washed, partially dried, and then perforated wherever cavities are necessary for effectually cleanising them after everyday



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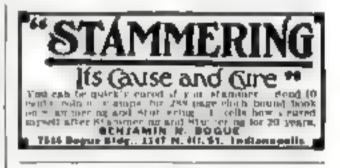


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From: Core ament terms | 1964-7 Bearings, fire Tork

See New Financial Department on Page 4-front section.

Our Haphazard Signs

(Continued from page 30

foot off the accelerator, or maybe even step on the brake, and drop to fifteen or twenty maies before you pick out the other words. Then, if you re in a lurry, you open up again, with language rising involuntarily within you. And a little later on, when you see another on STOP vari ande along at thirty-five, until suddemy you notice that it reads -

STOP!

Dangerous Intersection

Well, maybe that time it doesn't make any difference. And then again, maybe it does. Every state in the Umon ought to legislate misleading and dangerous advertising signs out of existence.

GAIN, in the case of soute signs and A directions, there's an astonishing diserepancy between the best signs and the worst

More and piore, now, the states are taking up the practice that started in Wisconsin, of marking route signs by number. We followed them quite eastly through balf the country - Number 32 say, through Hanois, or "Nounber 14 through Missouri. On some of the main trails, such as the National Old Transroad to coast highway, we found fairly clear mark ngs 4 good part of the way, in red, white, and blue bands around the telegraph poles.

Hat if you want a real grade-A passle. try to find the National Old Trads highway, or any other, from Philadelphia to New York. Any stranger who can tarn that trick without stopping about seventy-one times to ask directions is entitled. to be best man at a welding, or anywhere esse. Try t in New Jersey around Newark or Engaleth, and into Jersey City

Cities and detours are the two though that make toorist rautes particularly bard to follow. For a city solution, we can turn to Maryland again. There, at the city outskirts on most of the main route highways, we found big signboard maps with the through route clearly marked.

DETOURS are, to be suce always an aborduration. When we went through Olmo and Mangan we found the trouble reduced to a minimum by splendid markangs for every corner Even though the detours were nometimes bumpy, they could at least be followed easily. But many states are not so careful.

In the first place, there's a world of difference in the ways road commissioners. steer vod into detours. In some states an effort is made, whenever possible, to do half a road at a time and allow travel. to continue, with as little difficulty as possible, down the other half of the road, by providing places where two cars could pass, or widening the wing enough to make two lines of traffic possible, a lot of time and trouble is saved motorists.

In other places the road commissioners block off and ways for miles, causing neediess delay and expense for the very public they are supposedly trying to benefit Again we found (f antinued on page 182)

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Real Auto Experience

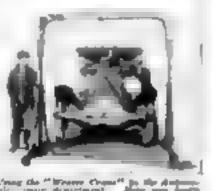
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By E. R. H. Prince Charles of 6

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By 7. P. O'Conney



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By Jerome E. Jerome

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By Judge Ban B. Lindsey



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Our Haphazard Signs

(Continued from page 1911)

the East behind the West in this regiect, Hardly a highway in the country, for instance, carries more traffic than the Boston Post Road. Yet the history of that thereoughfare, for the last ten years, is almost unnelievable. If I could have a dollar for every bump on the head I ve had from lutting the top of the car on a detour from the Boston Post Road, I d give the road сопивымичеть в финет.

IN KANSAS, Oklahoma and adjacent regious to add to the guety of motor ists, we found that a neighborhood rivalry had developed over routes. We would be traveling, let's my, on the Southwest Trad. Conflicting signs set up to rival countries or comm potter Dial also wanted our trade, would have steered us off to the Coast to Coast Highway or some other trail.

Then, there's the confusing track of musting that you see the center of every town you pass through. Even though the main muite goes, or should go, clear at the edge of the town, we would be donated by the signs over to the main street, through the thickest traffic, and then back again.

Varying state laws concerning speed and city regulations for traffic we found are still another source of trouble and danger. But this particular source of irritation has already been discussed in a terest some of Postage Scrawer MONTHLY I would add only this

Maryland and a few other states have set up, where the main hig mays crossthe state line, lng signbourds with the principal state road regulations and speed laws clearly outbued on them for visiting

inotoriets. That s a step worth copy ng. buildy, there's the question of hand signals. Motordom's milleuminin will have arrived when, and not before, the preserioed warmogs from one motorist to another are as uniform as we'd like to have the tradic regulations.

ON THE Pacific coast, the generally accepted agnals are: Hand up for a right turn, straight out for a left turn, and down for a stop. But we found that good proportion of the Midgle West waves its arm in a circle fue a right turn. holds it straight out or waves it in the opposite direction for a left tuen, and holds it up for a stop. In the East one set of signals prescribes that you point straight out with your finger if you're going to make a left turn, point at your own head as if you wanted to shoot yourself for a right turn; and hold your hand straight out with the palm turned back if you're going to stop.

But the most widely accepted rule in the East-at least around the larger cities—is just to dangle your hand over the left safe of the car as a warning that you re going to do amething. The fellow behind you has no idea what it may be; possibly you don't know yourself. But at least-unless you're merely knocking the ashes off a eigarette— be's had a fair warning that you're going to do something, and from then on he travels at his OWR TISK, as well as yours.

Can You Fix it?

Require any had to fault heavy how NOW You can do a fewer of the controller of the designation of the designation of the designation of the fewer of the majoreth was a bloom should be under our out the second burners of the second bloom between the second burners of the second bur Working Strong recture.

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POPULAR SCIENCE MONTHLY 250 Fourth Ava., New York City

Thrills of Modern Explorers

(Cant. and from page 42,

tule rises and falls, gates in the dams permit maintenance of differences in water level during part of the tidal These differences produce the necessary heads of water for the production of power through turbues.

They are trying it out now in England and France, save Mr. Marmer to see how much "white coal" they can get from the ocean. On the Severn in England, with a twenty foot tide range, and near Brest in beance where it is over lifteen, experments are being made

"Pegasus, or Problems of Transportation"

By Col. J F C. Fuller. Public a v E P Dutton & Co

PACIFIED tanks," roadless vehicles with exterpular treads, can be the means of opening to commerce the re- [maining from the countries of the world

War moust, or that ten years ago first cranched their way over German trens has eart now in peaceful guese, overnor track less countries and place at the world disposal their instructed riches, at the same time opening them to Europe a sor-plus population. The remaining frontier constries of Africa, Asia, the British Don't man, South America, even our own Plauppines or Anna can thus be winfar more rapidly than the "Iron Horse. wor the American West

This is the benef of Colonel Fuller former chief of staff of the British tack corps, and he bases it not only on experiments made in England but on the recent expant of Citroen enterpillar cars in crossing the Sabarn. Tanks, he points out reed have no tracks laid for them, nor roads made; they need neither coal nor wood. This keeps the expense down such vehicles, carrying a twenty ton netroad, can be run for alightly less than four cents a ton-in le, aican-aig overheid clarges, depreciation, interest and all ruttering changes.

THE vistag this plan opens are limit-I less and, as the tank expert points but, not so visionary. The latest British. tanks make twenty mines an hour, and there are amphibious tanks that carry cannon across streams. A tank scaled the Palacades of the Hodson not long ago. What tanks can do, peaceful roadless. vehicles can do, too. What other vehicle s there that can go safely about anywhere except over a precipice? Not locomotives, trollevs, trucks or wagons. Let most of the world is still reasiless.

So Colonel Fuller's plan is to open with road ess vehicles, the back country that radrosos do not reach. The wealth created will permit building new railrands later. He sees two types of pacified lanks. The smaller type with wheels in front and tracks in rear, would gather the produce from village, more and farm and draw it to intermediate stations. Here it would be shifted to monster types, all tracked, plying between these stations and radroad termina.

They Laughed When I Sat Down At the Piano But When I Started to Play!~

Can be really play " I beard a girl whosen to Arthur as I am down at the place

terbur exempera. He pever played illusers to the life

The all gave them the agent send their hard. I started to play Instantly a tense of the H to the gibbs. I played the first few to and He house a minorial Made light florants. Then it as a disc agenout. My friends

A Complete Triumphi

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Then I told them the whole story

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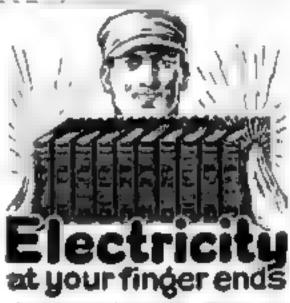
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Here Are Correct Answers to Questions on Page 48

 At the small town of Summerland, Calif., oil seepages were noticed at the seashore. Some of the wells drilled actually are out under the ocean. The derricks and pipe lines are built on stilts several hundred feet off shore.

 According to the census of 1920, the center of population was located in Owen County, Indiana. Fifty years ago it was near Cincinnati. It is slowly moving west, as the settlement of the Western states increases.

3. In the summer, northern Alaska has days twenty-four hours long. On the other hand, the winter season brings continuous night.

4. In the bottom of the valley in which lies the City of Mexico, there are still several small lakes. In one of these, Lake Xochimileo, natives have built gardens on masses of peat that float on the surface of the water. Here are raised most of the fresh vegetables that the City of Mexico consumes.

5. Off the coast of southern Florida the current of the Gulf Stream averages about two miles an hour.

6. South America. Vast areas in western and southern Brazil, in northern Bolivia and in the interior of Colombia and Venezuela have never been examined with completeness by civilized people. Even in Argentine there are areas which are imperfectly known.

 This famous building is an ancient fortress, still standing on a night hill within the city of London on the north bank of the Thames River.

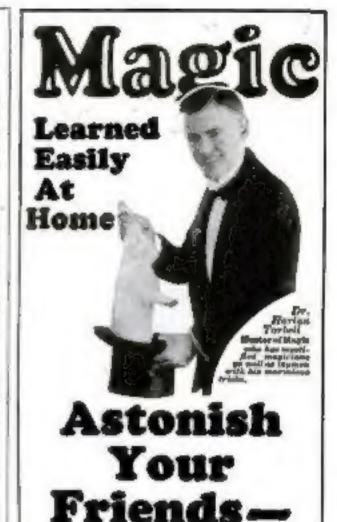
8. All through the equatorial or middie part of Africa the natives communicate from village to village in this way. The codes by which messages are sent are not well understood by the whiter, but news is spread in this way with great rapidity.

9. Near the ancient city of Thebes in anothern Egypt, not far from the modern town of Luxor, there still stand two large statues cut out of stone by the ancient Egyptians. It is said that the heat of the rising sun caused the stone of one of the statues to expand so that a sound was produced as though the statue spoke.

10. This is a custom in the southern part of India, where certain kinds of so-called "erible earth" are common articles of commerce. Balls of this earth may be purchased almost anywhere in the bazases. The reason for this curious custom is obscure. The earth contains little nutriment, if any, although it is barely possible that some of its mineral constituents, for example, iron, may be slightly beneficial to the health.

11. This was one of the customs of the native kings who ruled the Hawaiian Islands before the conquest of these islands by the whites. These cloaks were made from the feathers of a small bird native to the islands. Many women worked for a lifetime collecting and piecing together enough of the feathers to make a cloak for the king.

12. The tallest known ferns exist in the Hawanan Islands, where they grow to a beight of thirty or forty feet.



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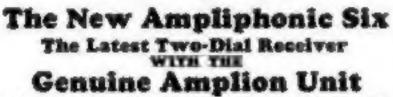
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